AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 23 — NEW YORK AND LONDON — NUMBER 40

INDIANAPOLIS OCT 6 1900 PUBLIC LIBRARY

Published at 218 William St., New York,
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

JOHN A. HILL, President and Treasurer.
A. LEIGHTON DONNELL, Sec'y.

Also published at 34 Norfolk St., Strand, London, W. C.,
Every Saturday.

FRED J. MILLER, Editor.

FRANK RICHARDS,
F. A. HALSEY,
EDWARD P. BUFFET,
} Associate Editors.

Representatives of Business Department
ANGUS BALLARD, for New England.
JOHN MCGHIE, for Middle States.
WILLIAM R. WALLIS, for the West.

Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$3 per year in advance, postage paid, in North America.
$4 per year in foreign countries, postage prepaid.
No back numbers beyond current year.
For sale by newsdealers, generally.

AMERICAN MACHINIST CO., Ltd.,
34 Norfolk St., Strand, London, W. C.

ADPHE. JANSSENS, Ingr.,
16 Place de la République, Paris.
10 A Boulevard Barthélemy, Bruxelles.

V. LOWENER,
Copenhagen,
Representative for Denmark, Norway and Sweden.

GUSTAV DIECHMANN & SOHN,
Neue Promenade 4, Berlin,
Representatives for Germany, Austria and Holland.

J. F. VILLALTA,
Puertaferrisa, 7-9 Barcelona,
Representative for Spain.

Entered at New York P. O. as second-class mail matter.

Cable address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

Large Business Enterprises vs. Monopolies.

We have received a letter from one of the readers of the "American Machinist," which letter indicates that he utterly fails to understand our position regarding the anthracite coal miners' strike and the anthracite coal monopoly. While we do not think that any great number of our readers so utterly misunderstand us, still if there are any others that do it may be worth while to state our position more fully and perhaps more plainly than we have hitherto done. The writer of the letter referred to charges us with blaming the coal operators simply because they are rich and with taking the side of the miners simply because they are poor and with wishing to take from the larger incomes of the few to give to or to increase the smaller incomes of the many. It is unfortunate that many public questions are so mixed up with partisan politics and with the socialistic program, that it is difficult to discuss them at all without danger of being charged with favoring the one side or the other in all its propositions. There are, for instance, people who do believe in the principle expressed by the motto, "From each according to his ability; to each according to his needs." This we understand to be the essence of socialism. We do not in the least believe in it, and yet because we blame the coal operators for refusing to confer with their men we are entirely misunderstood and thought by one reader, at least, to favor a doctrine which we do not at all favor, but oppose.

We think there is generally much too little discrimination in such matters as these. On one hand we have a great many people, especially among the workingmen, farmers, etc., who are opposed to and prejudiced against every company, organization, business or enterprise of every kind that is carried on on a large scale, or that is owned or managed by wealthy men, especially if their business is incorporated. They believe that "large aggregations of capital" are in themselves wrong, injurious and dangerous. To know that a man is wealthy, that he holds stock in and perhaps is an officer of a number of corporations is enough for them to class him as "unsocial," dangerous and wicked. In the estimation of these people, many of whom are well meaning enough, but simply misguided and mistaken, every large enterprise, from a department store to a locomotive factory or a railroad should be broken up as dangerous. In other words they do not discriminate between monopolies that are really injurious to the public welfare, and perfectly legitimate and competitive business enterprises that enjoy no monopoly whatever, but that are simply successful competitors for business—successful perhaps mainly because they do command large capital and can for that reason give patrons more for their money than it would be possible for a smaller concern to give.

We sincerely think it would be far better for all of us if people generally were to be more discriminating in discussing these matters—if they were more careful not to condemn or oppose perfectly legitimate and fair wealth getting or possession on the one hand, nor to uphold or defend really unjustifiable, injurious and wrong monopolies on the other.

We believe it is perfectly proper and entirely honorable for a man to aspire to the possession of wealth and to attain it by any fair and honorable means. Moreover, we do not take much stock in what is called the "stewardship of wealth." On the contrary, we believe a wealthy man has a right to do as he pleases with his wealth and that no one nor the community should dictate to or coerce him in the matter of the disposition or use of his wealth, so long as by his getting and using it he does not interfere with the rights of others. We believe this country affords many opportunities for many men to acquire competencies and even to become moderately wealthy without doing others any injustice whatever, but on the contrary, doing good all the while to the communities in which they work and do business. We do not believe that such a man whose wealth has been acquired in perfectly legitimate and fair ways is under any obligations whatever to build churches, found libraries or to donate or bequeath his wealth or his titles to wealth in any way except as in accordance with his own wishes and the dictates of his own conscience. We cannot consistently give credit to or love men who are generous and public spirited, and give freely of their wealth for the public good unless we unreservedly concede their right to be and to do otherwise if they choose. We believe that a man who has honestly and fairly acquired the materials and has himself constructed a useful or ornamental article, let us say a table, really and absolutely owns that table and has a natural and moral right to dispose of it as he likes, to keep it, to give it away, to sell it, to chop it to pieces, or to burn it up. We, furthermore, believe that another man who pays the table maker his price, either for the table or by the day for making it, acquires the same absolute natural and moral right to the table that its maker had and ought also to be allowed to dispose of it as he sees fit without dictation or interference by others. We believe that if a man were to go into the table buying business and were to buy all or nearly all the tables in any country or in the world, paying for each a fair price to its maker he would have the same right to dispose of these tables as he might think best and that no one, nor any legislature, nor any organization of any kind, political or otherwise, ought to be allowed to dictate to him as to how he should dispose of *his* tables. But if this man should undertake to secure a monopoly of the materials of

which tables must be made, or if he should directly or indirectly attempt to control the highways or the means by which other tables could be made and transported to the places where they might be needed, then and only then would he be attempting a monopoly of the table business; then and only then would the community have a right to step in and protect itself, *i.e.* to protect the equal rights of all, who might be so disposed to acquire the materials, to make, to ship and to sell tables.

We believe that it is as much a mistake and as serious a mistake for a wealthy man to indiscriminately uphold monopolies of all kinds and to regard attacks upon them as "attacks upon property," as it is for the other people to indiscriminately fight against all wealth and all large enterprises and to oppose department stores, large machine building establishments and large everything, including our patent system, the same as though they were real monopolies, such as the anthracite coal monopoly. Unfortunate as it is that we have people who take this last-mentioned narrow and one-sided view of things, it is equally and perhaps more unfortunate that we have another class of people, mostly to be found among the rich, or their retainers and sycophants, who seem to always espouse the side of the powerful, the wealthy and the big, utterly regardless of the merits of the case and no matter whether a monopolistic or a competitive principle is involved. On the one hand we have people clamoring against and railing at all wealth and wealth-getting methods, regardless of the right or wrong of those methods and no matter whether the methods are monopolistic or purely and strictly competitive, and on the other hand we have people who regard every criticism of the actions of wealthy men or of powerful companies and every cry against monopolies, no matter how palpable or injurious they may be, as an "attack upon property," or a "threat against vested interests." The one side is as unreasonable and misguided as the other, and it is hard to decide which is doing most to cloud the atmosphere and work mischief.

It has been abundantly proven, for instance, that certain railroads by concerted action have arranged so that they themselves mine or are the only ones to whom others that do mine anthracite coal can sell any of it. That they have fixed, by agreement, the rates for transporting this coal at such figures as not only to make the coal mining end of their businesses make a needlessly poor showing, but also to prevent the relatively few independent mine owners or operators from competing with them on anything like equal terms. Controlling, as they do, the only highways by which this coal can reach the market, they entirely ignore their duties as common carriers and use their advantage to grind the miners and oppress independent mine operators on the one hand and to rob the coal consuming public on the other. That they do this rests upon the testimony of no less a man than the late Eckley B. Coxe, who was a large independent anthracite mine owner, a skilled engineer, a very wealthy man and a man whom to know was to admire and love. His testimony before the Interstate Commerce Commission, published in 1893, fills a large volume that ought to be carefully read by those who think that when we criticise this abominable and outrageous coal monopoly for refusing to even meet and confer with the representatives of its employees, we thereby mean to divide up wealth between those who now have it and those who would like to get it.

We think those people who are either mentally too lazy, too dull or too thoughtless, too careless or indifferent to think out the essential difference between a department store or a large machine building company—neither of which is in any sense a monopoly, even when the latter is based upon valuable patents—and a real monopoly such as the anthracite combine or the Standard Oil Company, ought really to take time to study it out and not waste time and ink writing to us upsetting a man of straw which they have constructed themselves, because they have utterly failed to understand what we have said or what it is we are in favor of or opposed to. We cannot undertake to discuss every difficulty that arises between employers and employees, principally because most of such difficulties are, so to speak, "none of our business." They affect the employer and his employees only. But this coal strike affects everybody, and is everybody's business. The public is interested in it as a third party, and it is a proper subject for public discussion, although even in that discussion we distinctly avoided attempting to decide whether the men or their employers were right on the points at issue, and criticised only the operators' refusal to meet and confer with their employees or with men chosen to represent them.

We strongly believe that manufacturers and others who are engaged in perfectly fair and strictly competitive businesses, as many of them, large and small, really are, make a serious mistake when they attempt to uphold or defend palpable and outrageous monopolies that are robbing the people, including these self-same manufacturers, simply because they fear it may lead to mischief. Their attitude is analogous to sitting on the safety-valve to stop an annoying noise or waste of steam.

Many of the so-called trusts that we hear so much about are not really trusts at all, but perfectly legitimate and proper commercial organizations; controlling no monopolies either of raw materials, lines of transportation or anything else; they must succeed, if at all, simply because they can give more value for a dollar than others, or because they do give such good value for a dollar that capital is not attracted into an effort to compete with them. We believe in the moral right of every such business to exist and to grow as big as its managers can make it. But when the money or the power so gained is used to secure an unfair advantage or prevent freedom of competition that is another thing, and every good citizen, rich or poor, ought to oppose it.

The columns of the "American Machinist" are not to be devoted to such opposition, nor do we invite discussion of such matters. This is written simply as an explanation of our attitude toward these matters and to protest against being regarded as an advocate of socialism, simply because we have criticised the action of a monopoly and have said that we believe our supplies of coal ought not to be subject to a monopoly.

Helical Back-Gears on French Lathes

In an article entitled "Lathes at the Paris Exhibition," published in "Engineering" of September 14, French lathes are spoken of, and the statement is made that "French makers do not, as a rule, go in for broad belt cones, nor make a difference in the pitch and widths of first and second-motion back gears. Nearly universally these are of single helical type, and the teeth are set in reverse directions on back and front of the cones, with the object of balancing the endlong forces, due to the single helical form."

While this is true enough as far as it goes, it seems as though our contemporary might have gone a little further and said whether or not the object sought "of balancing the endlong forces, due to the single helical form," is attained. In our issue No. 29, at page 687, the statement is made, in our Paris correspondence, that this object is not really attained in that way and that the French builders who have followed this plan have overlooked the rather important fact that the gear at one end of the back-gear quill is driven, while the other is a driver, and consequently that the teeth should be set in the same direction, instead of in reverse directions; or, in other words, that by taking pains to make the teeth incline in reverse directions, the French builders have intensified the very evil they sought to avoid. It is our belief that if you are going to make helical teeth in lathe back-gearing, the direction of the inclination should be the same in both pairs of gears, and that the angle of the smaller gear on the back-gear quill should be less than that of the larger one in proportion to their difference of diameter.

It would not be easy to say how far the effects of the coal strike may reach. They must of course extend at once to the other side of the Atlantic, where we have been expecting to develop an extensive and permanent trade. The higher our price is, the less of course we can sell. One effect

was not long in striking our eyes in the view from our editorial windows. One or two enterprising—if that's the adjective—concerns found immediate excuse for going into the burning of soft coal, and from a pair of big chimneys of an electric station the dense black clouds began to pour almost continuously. We are happy to note that, as we write, the power of the Board of Health and of almost unanimous public sentiment has proved effective in banishing the calamity that was threatened.

Examination for Naval Draftsman.

The United States Civil Service Commission announces that on October 23, 24, 25 and 26, 1900, an examination will be held in any city in the United States where it has a local board of examiners for the position of mechanical draftsman for marine engines and naval construction. The examination will consist of the following subjects: Applied mathematics, design and constructional details, drafting, technical education and experience. Competitors should provide themselves with all instruments necessary in drafting work. Special credit will be given for experience in naval drafting work. It is the desire of the Department that the appointee in this position have a good general education and be of genteel appearance and manners, for the reason that he will be required to assist in the instruction of naval cadets. The subject of drafting will embrace freehand sketching of models submitted; the making of working drawings of the same to scale; complete pen and ink drawings of other pieces of mechanism, including tests in block-lettering; also the making of complete drawings to scale from portions of blueprints of machinery submitted, etc. From the eligibles resulting from this examination it is expected that certification will be made to the position of draftsman at the Naval Academy at a salary of $4.00 per diem, and to similar vacancies as they shall occur. Persons who desire to compete should at once apply to the United States Civil Service Commissioner, Washington, D. C., for application forms 304 and 375, which should be properly executed and promptly filed with the Commission.

The business men of Spain hold no grudges against us, or at least not to interfere with their present and future interests, and the business that belongs to us is coming our way. The Great Southern of Spain Railroad has ordered fifty cars from the Pressed Steel Car Co., of Pittsburgh.

Two side-wheel steamers on Lake Michigan recently raced from Chicago to St Joseph. The distance is 59 miles, and the winner was only one minute ahead at the end. That is the kind of race that a fellow would like to see. It cannot be said to have proved anything as to the superior speed of the winner.

Commercial Review.

New York, Monday, Oct. 1, 1900.

MACHINERY AT HOME AND ABROAD.

Domestic trade in machine tools remains quiet. Reports from Cincinnati indicate that things in that region are pretty blue. It is fully confirmed in the New York district, however, that some of the delay in placing orders is due to the uncertainties of the election. An improvement following that event may logically be expected. unless the result should be considered in itself harmful to business.

One of the Eastern railroads has nearly completed plans for a new car shop in which will be installed some sixty or seventy wood-working machines. Its method is to submit these specifications for all the wood-working machinery, including such auxiliaries as shafting, to not more than a few concerns to be estimated upon by them as a whole, rather than to throw open the contracts for scrambling and sub-division.

Business conditions upon the continent of Europe show tendencies which need not cause discouragement in this country, but which must be taken account of when considering future markets for American goods. Fresh information has reached us, through a reliable channel, that a period of steady depression seems to be settling down upon Germany and neighboring regions, such as Austria, Russia and Scandinavia. Conditions change gradually in those parts of the world and the present depression is advancing in a conservative way which, it is feared, bodes a continuance of several years. It is attributed, in a considerable measure to over production, and this remark has especial reference to the iron trades of which machine tools are no insignificant feature. The imitation of American tools in Germany has grown to a considerable magnitude, and this is believed by many to interfere with sales of the genuine American machines, because the German imitations are offered at lower prices. No one knows, however, or can know just how many orders that are filled by copyists of American machines would have been secured by the American builders themselves if there had been no copyists. Certainly not all of these would have been and perhaps far fewer of them than the American builders might be led to think. The foreign demand for small American machinists' tools is said not to be falling off appreciably, since these are in the nature of regular manufacturing supplies.

One of the American machine tool men who has been abroad this season brings back a report that the Paris Exposition is in one way having an actually retarding effect upon the demand for tools—would-be buyers are waiting till the show is over, with an idea that the machines now on exhibit will then be thrown on the market for what they will bring and there will be a chance to get some bargains.

The financial aspects of Russian business, which are constitutionally such as to make it necessary to take exceptional precautions when trading there, have grown worse in the last two months and credits are more than ever precarious. A certain Russian engineering trades firm of German origin, which was doing business there with a capital of several million rubles has lost the greater part of that sum within a short time, largely through failures among its clientage.

A slender ray of light comes from the Spanish market. The withdrawal of Spanish capital from Cuba has stimulated its investment in home industries. An actual betterment in demand for machine tools in Spain, which is noticed by a prominent continental house and which has resulted in some good sales of tools of American make, is ascribed to the cause named.

The gravest feature for us in a general European depression would be the likelihood that it would carry America bodily with it. Although the ups and downs of American trade are generally regarded as if of local origin, it is undeniable that the depression in the United States during the middle nineties, as well as the periods of activity which preceded and followed, were nearly coincident with similar epochs that extended the earth over. It is more than probable that we shall continue to conform to the trend of business throughout the world.

But we do not think that prospects, as a whole, are as bad as the opinions just stated would indicate. While there are some unfavorable features there are others distinctly promising, particularly the future markets in Africa and Asia. Great Britain, to which country reference was not had in the pessimistic remarks that have been made, is just emerging from the mire and will make things industrially lively in South Africa and elsewhere as soon as she gets a chance. The Chinese matter is a sorry mess at present, but when some sort of order has been evolved out of its chaos, there will, no doubt, come a great uplift to the foreign business relations of all the great commercial nations of the world, in which the United States will share through the European exports of her machinery builders as well as through the Far Eastern exports of all her manufacturers. Moreover, the impression that has already been produced in the European mind by American machinery will not soon be obliterated. That same conservatism which postponed the recognition of American machine tools should occasion their continued import now that they have gained a foothold, even after the exigencies which rendered them indispensable have passed away.

In connection with the Spanish market for American machinery, which formed the subject of an article published in our last number and has been alluded to in the present notes, we offer the contents

of a letter just received from that country, which gives promise of some substantial business for tool manufacturers and others. This letter is from J. F. Villalta, Puertaferrisa, 7 y 9, Barcelona, who is an importer and commission merchant of machinery and tools of all kinds, exclusively of American make. He writes that he is open to receive tenders for machinery, supplies, etc., for a new shipbuilding and repairing plant. The concern from whom he has received this commission has an invested capital of 30,000,000 pesetas and is to spend $800,000 in machinery, etc., at the time being. He wishes also to obtain for several customers 8 and 10 foot boring and turning mills, horizontal "floor-boring," drilling and turning, mills, six-spindle multiple drills, circular style, universal milling machines, profiling machines, steam and drop hammers, water emery grinders, etc., modern machinery for blast furnaces, rolling and drawing mills. Furthermore Sr. Villalta is open to receive tenders on good quality American coal and to close contracts for the shipment of 15,000 to 20,000 tons as a first order for trial. Prices f. o. b. Barcelona are wanted, also the time of deliveries, terms and conditions, and in order to save time a "pro forma" contract and invoice. As this coal affair is very urgent he thinks it will be well if each interested concern will wire immediately the price per ton or 1,000 tons, f. o. b. Barcelona, naming quantity that can first be delivered and date of shipment, also the quantity that can be shipped monthly.

Ludwig Loewe & Co., of Berlin, are said to be extending their distributing facilities by extablishing new branches in Germany and France.

CHICAGO MACHINERY MARKET.

Some machinery men at Chicago say they can see in the action of certain large buyers of machine tools a marked amount of preparedness for the coming election. They are putting their respective houses in order in a way, restricting lines of credit and expenditure, and arranging their affairs for a new start, much as they do at the beginning of each year. These remarks apply to the more conservative users of machinery. Trade in machine tools during September, according to the verdict of the majority of the principal sellers in this market was quite moderate. It barely reached the aggregate of August. Some dealers report a gain, ranging as high as twenty-five per cent.; others say business showed a decrease. When explanations are asked for, the usual reply is that the election is influencing trade. This does not state the whole situation. There are sellers who look for a much better trade in October than they had in September. They say they have been doing a large amount of missionary work during the past few weeks and that returns are due. A number of negotiations, involving considerable machinery, are pending and some of these are, from all appearances, on the point of dropping into the order books of the factories. One of the northwestern railways has completed a new shop and is delaying the equipment of it because, on account of the failure of the crops, the road will have this season scarcely one-third the grain to haul to market which it carried last year. But the shop yawns for its furniture and purchases can not be long delayed. The machinery for the new Chicago & Alton shops at Bloomington, Ill., has not yet been purchased, but action is expected within a short time. There are other projected enterprises in various stages of progress, for which machinery purchases are only a matter of time in the ordinary course of events.

Prices are without change, except for some of the smaller tools among which the tendency is towards a lower range. For the large tools there continues some delay in filling orders, but there is not enough complaint of that kind to talk very much about. It seems little more than the usual time limit required to complete tools not kept regularly in stock. There is, in fact, very little complaint of any kind. The more moderate volume of trade is accepted by the trade with marked equanimity as if it were a matter to be expected. The dullness does not aproach the degree that was experienced four years ago during the hight of the presidential campaign and comparisons are not so unfavorable when made with any other year than 1899.

Among the orders recently taken by J. B. Doan & Co., was the complete outfit for the new shops of the Buckeridge Pump Company, Wichita, Kan. Rudolphi & Krummel report trade in excess of that for September last year, but not quite up to that of August.

PITTSBURGH TRADE REPORT.

Outside of an additional faint increase in the aggregate tonnage in finished lines there is nothing special doing in the iron and steel lines in this district. Business has not declined any, but mills are not rushed with work and the disposition is not to buy for some few weeks yet. The early future presents a favorable aspect and it will not be surprising to see the market take on a better feeling as soon as the presidential campaign is over. As has been the case for some time past, there is a tendency to wait, and this is causing a weak demand for material. Stocks are quite heavy and what few sales have been made have made little impression on the stored articles. This is the case in most lines, not particularly pig iron, but in many lines, such as merchant mill products, etc. With the small amount of business doing prices are being held firmly.

Inquiries are coming in better than for some time past and in these is the basis of belief among producers that with the election out of the way business will assume a normal condition. Prices will not go any lower, unless there is a killing cut made in all directions and this is hardly likely. Foundry irons are selling at $15 per ton for No. 1 and $14.50 for No. 2 grade. No. 3 is 50 cents cheaper.

In machinery circles there appears to be a good trade going and inquiries are coming in more frequently than for some time past. Many improvements are contemplated in various establishments throughout the Pittsburgh district, and all handlers of tools confidently expect to be kept on the run as soon as the new work is to be taken up.

Contractor Ed. E. Erikson, Pittsburgh, is now engaged in making plans for a two-mill tin-plate plant at New Kensington, Pa., to be built by Messrs. Oliver H. Burgman and others. The new sheet and tin mills at Waynesburg, built by Messrs. Tyler and others, of Washington, Pa., will be ready for operation in a few days.

A good order for gas engines was given to Somers, Fitler & Clarke, of Pittsburgh, this week by the Oliver Iron & Steel Co., for operating several of its mills. There will be two 100 horse-power and one 80 horse-power Otto engine installed. Of late there has been quite a demand for gas engines for rolling mill work and there is no question but that some day they will become of general use.

Quotations.

NEW YORK, Monday, Oct. 1, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$16 00 @ $16 50
No. 2 X foundry	15 25 @ 16 00
No. 2 plain	14 75 @ 15 50
Alabama Irons:	
No. 1 foundry, or soft	16 25 @ 16 75
No. 2 foundry, or soft	15 25 @ 15 75
No. 3 foundry	14 75 @ 15 25
Foundry forge	13 50 @ 14 00

It is understood that a reduction of 50 cents a ton in freight rates to New York on Alabama irons has been made, though brokers of whom inquiries were made today were still awaiting confirmation of this. The reduction is not allowed for in the above quotations.

Bar Iron—Base sizes—For refined brands on dock, 1.40 @ 1.45c., and 1.65 @ 1.85c. for same from store.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c. and upward.

Machinery Steel — Base sizes — From store, 1.55 @ 1.75c.

Cold Rolled Steel Shafting—Base sizes—From store, 2½ @ 2¾c. generally.

Copper—Lake Superior ingot, in carloads, 16¾ @ 17c.; electrolytic, 16⅝ @ 16¾c.; casting, 16½ @ 16⅝c.

Pig Tin—29 @ 29⅛c. for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—Prime Western, 4.15c. asked, New York delivery.

Antimony—Cookson's, 10½ @ 10.90c.

Expansion Mandrel for Piston Rings.

BY GEO. R. MARTIN.

I have frequently seen suggestions for facing piston rings down both sides at once; I have also seen a good many different strong language cultivators, which have had nominally this end in view, such as a cylindrical casting with four set screws tapped in the side upon which the patient mechanic was invited to use his skill in balancing a ring; or again a four-jaw chuck with pieces of wood packing to give a clearance for the tool, the first of which would always insist on dropping out just as one happened to be trying to persuade the last to submit to be fixed.

But perhaps instead of recalling the trials of patience which everyone at some time or another has experienced, it would be better if I proceeded to describe a mandrel which I got out for this purpose.

Fig. 1 shows a sectional general view of the arrangement. It will be seen that the body casting has a spigot *G* to fit in recess bored in face-plate of lathe and ensure rapid setting, and here I might say, see to it that all lathes right through the shop are recessed to one size and all jigs and registers made to this standard and then there will be no necessity for Tom to be standing cooling his heels because the jig for the work that is wanted only fits Bill's machine, and Bill is getting out of temper because he is overcrowded and the boss keeps coming along to see what chance there is of getting that breakdown job started.

However, to return to our mandrel there is a taper cone *A* with feather to prevent turning (for details see Fig. 3), also expansion disk *B* bored to same taper (for details see Fig. 6). Screwed into this cone is the sleeve *C* free to slide on the center stud *D*. The method of operating is evident. Suppose a ring to have been just finished; nut *F* is slacked back just sufficient to allow sleeve *C* to move, which is then in turn slacked, forcing cone *A* out of expansion plate *B* and thus allowing the ring to be slipped off. Now another ring would be placed in position and nut *F* and sleeve *C* screwed up finger and thumb tight to prevent slipping and then the ring set true by running lathe and placing the back end of tool to face of work. Sleeve *C* is then tightened sufficient to hold ring firmly, being careful not to tighten it so much as to burst the ring, and lastly nut *F* is screwed home, securing the whole.

I have given particulars and dimensions of two which I had made and these took all sizes of rings from 6 inches to 25 inches.

Thames Ditton, England.

The State Department at Washington has received a note from the Legation of Sweden and Norway inclosing a copy of the laws and regulations relating to a bequest of Dr. Alfred Bernhard Nobel, engineer, who left a fund, the income of which is to be employed in the presentation of prizes each year to persons who in the year preceding shall have rendered the greatest service to humanity in certain fields. At least once in five years an award will be based upon work in physical science and will be made by the Royal Academy of Sciences, at Stockholm. The first award under the bequest will take place December 10, 1901.

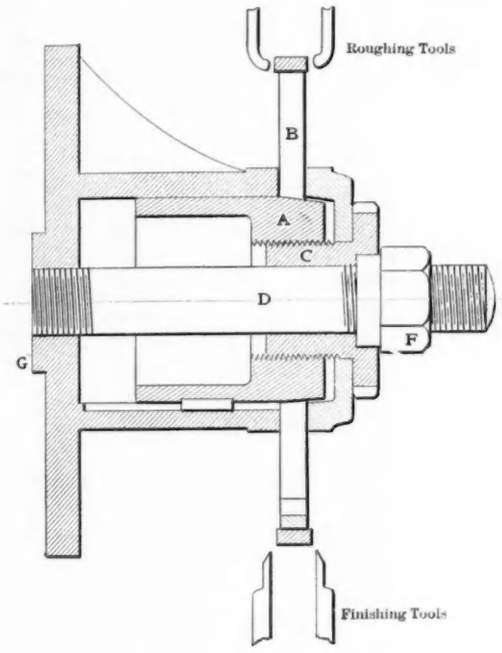
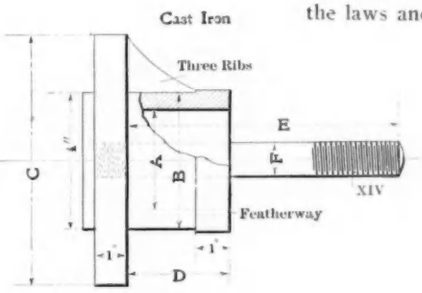
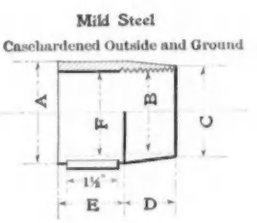


Fig. 1



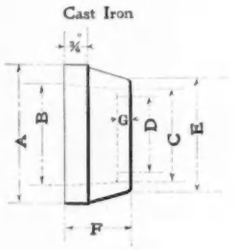
A	B	C	D	E	F
3"	4"	7⅛"	3"	8"	1"
6"	7⅛"	15"	6"	11"	2"

Fig. 2



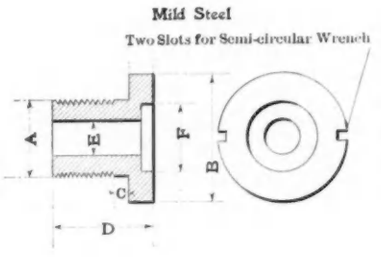
A	B	C	D	E	F
3"	2¼"	2⅝"	1½"	2"	2⅝"
5"	6"	3½"	5⅛"	1½"	4"

Fig. 3



A	B	C	D	E	F	G
4½"	3"	2⅜"	2¼"	3⅛"	1¼"	⅜"
7⅜"	6"	5⅛"	3½"	7⅛"	1⅝"	½"

Fig. 4



A	B	C	D	E	F
2½"	3⅛"	⅞"	3"	1"	2"
3½"	5⅛"	⅞"	3½"	2"	2½"

Fig. 5

Expansion Plate
Turned Outside to Suit Ring

Fig. 6

EXPANSION MANDREL FOR PISTON RINGS.

Switchboard Instruments—Recording Ammeters, Voltmeters and Wattmeters.

BY WM. BAXTER, JR.

Recording instruments are so constructed that they draw a line upon paper which is a record of the indication of the instrument at any moment during a certain period of time. Among instruments of this class may be mentioned those made by the Bristol Company, which have the same external form as the familiar recording steam gages from the same house. The electrical portion of three such instruments is illustrated in Figs. 1, 2 and 3; the first being a voltmeter, the second a wattmeter and the third an ammeter.

The action of the voltmeter is as follows: Two coils, *A* and *B*, are set parallel with each other, the first one being secured to the frame of the instrument so as to be stationary, and the second one being carried by the shaft *S* which rests upon the lower side of apertures in the springs *t t*. Through the two coils, which are made of many turns of fine wire, a small current is passed. To further reduce this current a separate resistance *R* is provided. The two coils *A* and *B* are connected in series with each other, and with *R*, and the ends of the wire are connected with the opposite sides of the main circuit, just as in the case of a simple voltmeter. As was explained in the first article on voltmeters and ammeters, the currents flowing in the two parallel coils will develop a repulsive force if connected in the proper relation, and this force will be proportional to the current strength, and the current strength in turn is proportional to the voltage between the opposite sides of the circuit, hence the movement of coil *B* away from coil *A* will be through distances proportional to the voltage. The coil *B* in moving sidewise carries with it the springs *t t*. The arm *P* that carries the marking pen, is attached to the right hand spring *t*, hence its movement will be proportional to that of coil *B*. The springs *t* not only serve to hold coil *B*, but also provide the force required to counteract the repulsion of the two coils. By attaching *P* to one of the springs *t* the construction is very much simplified, as with any other connection pivots and connecting links would be required.

Fig. 2 shows the arrangement of the coils for a wattmeter, and as will be seen they are apparently much the same as for a voltmeter, but there is more difference than the diagram shows. In the voltmeter the two coils are made of the same size wire, and this is very small, but in the wattmeter the stationary coil *A* is made of large wire. In the voltmeter, the same current passes through the two coils, one after the other, but in the wattmeter the whole current in the circuit that is measured passes through the *A* coil, while the current through the *B* coil is but a small fraction of the total, this latter coil being connected in the same way as the voltmeter coils, that is, with its ends to opposite sides of the main circuit. As in the voltmeter, the coil *B* moves and is carried on the springs *t t* to the right side one, the pen carrier *P* being attached.

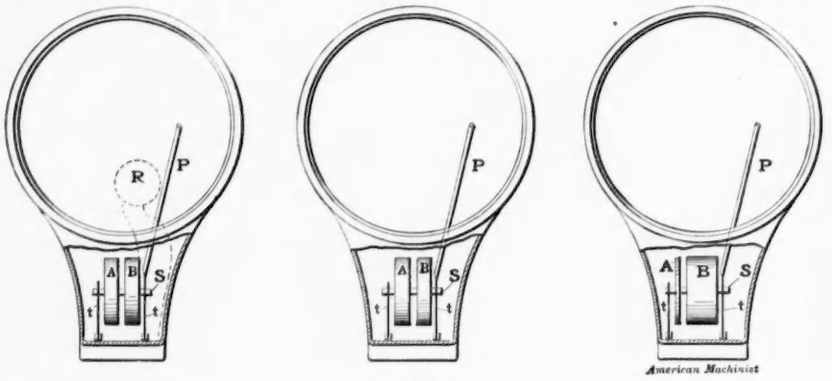


Fig. 1 **Fig. 2** **Fig. 3**

ELECTRIC PORTION OF BRISTOL RECORDING VOLT-, WATT- AND AMMETERS.

Fig. 3 illustrates the construction of the ammeter. In this instrument there is but one coil *B* which is connected in series with the main line. The magnetic force of *B* acts upon a thin iron disk *A*, which is secured to the shaft *s* and the side movement of *A* moves the pen carrier *P* just as in the other instruments.

In the instrument shown in Fig. 4, which is made by Elliott Brothers, of London, the record is made upon a sheet of paper that is unwound from a roll. The paper is fed at a uniform rate by means of a clock movement, which is shown more clearly in Fig. 5, which also shows the electrical portion of the apparatus. The strips of paper used are about 65 feet long and are reeled off into a suitable receptacle at the bottom of the instrument, and can be removed piece by piece, or not, just as desired. To insure positive motion of the paper, the unwinding clock mechanism is provided with a wheel that has pins upon its periphery and these fit into holes punched in one side of the paper at regular intervals. In this way danger of slipping and thereby irregular motion of the paper is avoided.

The electrical mechanism for ammeters and voltmeters is made up of a permanent magnet and a wire coil which swings around an axis set between the poles of the magnet. The construction of this part is well illustrated in Fig. 5. The torsional force developed by the current passing through the wire coil is resisted by springs which are arranged in a manner similar to that employed in the Weston instruments described in the second article on ammeters and voltmeters published in issue No. 11.

The permanent magnet and movable coil construction shown in Fig. 5 cannot be used for wattmeters, as with it the variations in power due to variations in voltage cannot be indicated, and on that account, for wattmeters, the electrodynamometer principle is utilized. When a permanent magnet is used, as in Fig. 5, the magnetic field in which the rotating coil swings remains constant, and the variations in torsional force are due wholly to the changes in strength of current passing through the coil. If the ends of this coil are connected with the opposite sides of the circuit, the current strength in the coil will vary with variations in the voltage, and then the instrument will register changes in electromotive force. If the coil is connected in series with the main circuit, the instrument will register the changes in strength of the total current in

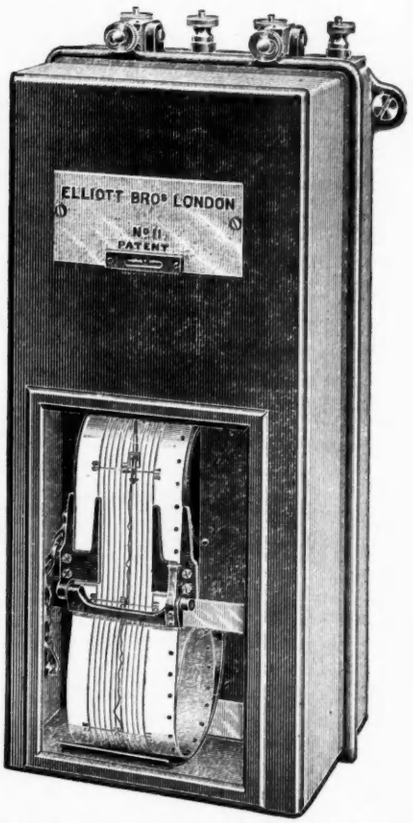


FIG. 4. ELLIOTT BROTHERS' RECORDING INSTRUMENTS.

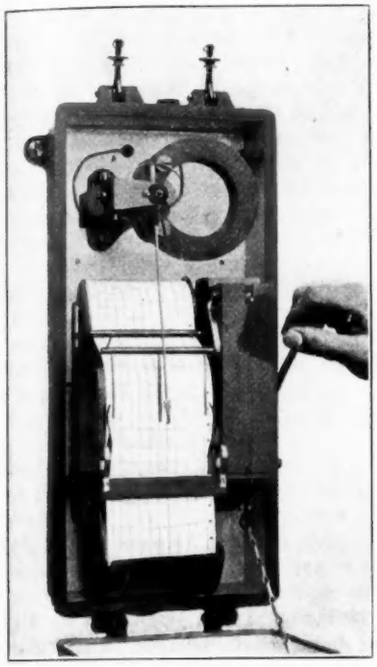


FIG. 5. INTERNAL CONSTRUCTION OF INSTRUMENT SHOWN IN FIG. 4.

the circuit. If two movable coils were provided, instead of one, the torsional force of the combination could be made proportional to the changes in the product of the volts and amperes at any instant, and thus the instrument would register watts; but such a construction would be objectionable in many ways, hence, it is modified by making one of the coils stationary, or in other words, by using this coil as a substitute for the permanent magnet. With this change the magnetic field in which the movable coil swings becomes variable in strength, and will increase and decrease with the current that passes through it. The rod that carries the recording pen is attached to the shaft upon which the movable coil is mounted and moves in unison with the latter.

The variations in the voltage of currents generated by properly designed and adjusted generators is small—seldom over 5 per cent.—hence a recording voltmeter can be made so that the pen will rest on the central line of the record when the pressure is at the standard, and will swing through a wide angle with a small change in voltage. Thus, if the instrument is intended to indicate 115 volts, its lowest limit can be 105 and its highest 125, and by so calibrating it, a small variation in pressure will produce a decided variation in the position of the record pen, and from the record line the slightest variations in the voltage can be readily noticed.

The scale of ammeters and wattmeters cannot be restricted to a small variation from the standard, for in almost every case, in actual practice, the current strength and the watts vary from a little more than zero up to 50 or even 75 per cent. more than the standard. On this account these instruments have to be made so as to indicate from zero up to as high a point above the full capacity of the generators, as may be necessary to be able to register extraordinary demands.

The variations in the voltage being small and not very sudden, the arm that carries the recording pen swings slowly, and the momentum it acquires is not sufficient to carry it any appreciable distance beyond the proper position; but the movement of the ammeters and wattmeters is violent and frequent, and unless some kind of damping device is provided, the momentum of the moving parts will carry the pen far beyond the proper point at each oscillation, and thus produce a record that is of little value. The damping devices used to steady the pen-carrier act upon the same principle as the dash-pot; but as the instruments must be made to move with a very small effort, weight and

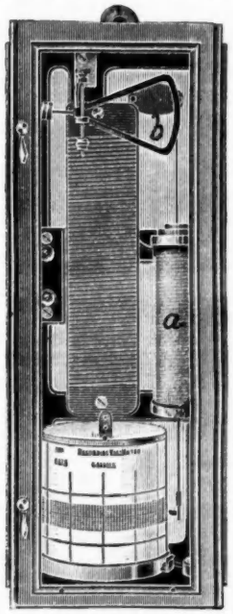


FIG. 6. THE KELVIN RECORDING VOLT- AND AMMETER.

friction have to be reduced to the lowest point. A comparatively small, flat surface placed at right angles to the line of motion, and moving in an inclosure from which the air cannot escape freely, provides all the damping action required.

The instrument shown in Fig. 6 is the Kelvin recording ammeter or voltmeter. It is of very simple construction, and the principle upon which it acts can be understood from the most superficial description. The roll of paper upon which the record line is drawn is located at the bottom, as is clearly shown, and it is rotated at a uniform velocity by a clock movement, just as in the instruments already described. The recording pen is attached to the end of a light rod, which is carried by a soft iron plunger working in the solenoid *a*. This plunger is suspended from a cord that is fastened to one end of a scale beam, which is mounted so as to move with the slightest resistance. On the opposite end of this beam weights are located, so that the downward pull of the solenoid is counteracted by gravity. The weights are so adjusted that the marking pen rests upon the center line of the record paper, when the voltage or the current strength, as the case may be, is at the normal value; then if the current reduces in strength, the weight will draw the plunger up, and the pen will trace a line above the center; and if the current increases, the force of the solenoid will predominate, and the plunger will be drawn down, and with it the pen, so that the record line will be below the center.

This instrument cannot be made in the form of a wattmeter, as it only has one coil. It could, however, be made to serve this purpose by substituting for the iron plunger another solenoid small enough in diameter to pass into the interior of *a*, but it is not so used. The Kelvin wattmeter is made upon the electrodynamometer principle, and is shown in Fig. 7.

Recording ammeters and wattmeters can be arranged so that the whole current in the circuit passes through the instrument, or a shunt may be used so as to reduce the strength of current, as was explained in the second article on voltmeters. As a rule, instruments of large capacity are provided with shunts, so as to avoid the use of large copper bars in connecting them with the circuit. The shunt, however, does not in any way affect the principle of action of the instrument, and does not materially simplify its construction; so that the main advantage derived from

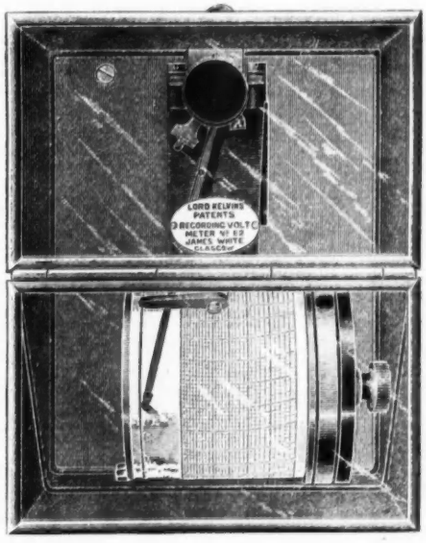


FIG. 7. THE KELVIN RECORDING WATTMETER.

its use is that the connecting wires between the instrument and the bus bars, or generator terminals, can be made of small or moderate size.

Twenty-seven small German towns are illuminated by acetylene gas. At Hassfurt, 2,500 inhabitants, the charge is 2pf ($0.00476) per 20 candle-power hour.

Soldering Plates for Small Work—Sawing Jigs—A Turned Helical Spring—A Filing Jig—Making Small Screws—Staking Tool.

BY A. H. CLEAVES.

A man came to Siemens & Halske's, in Chicago, last year, worked half a day and quit; and told the foreman, as a reason that "all the men used dose hooks (micrometers), and he vould not do." I

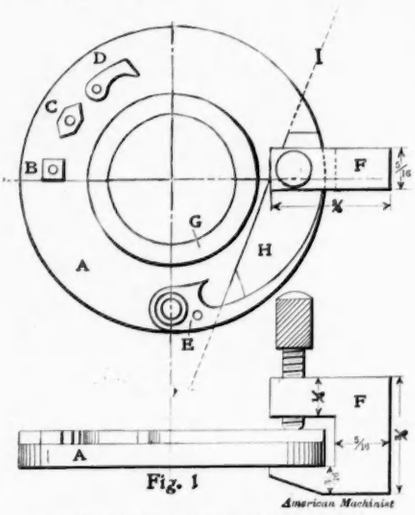


Fig. 1

SOLDERING PLATE FOR SMALL WORK.

suppose he would take but little interest in some of the following knick-knacks that I have picked up here and there and found quite valuable in my experience. Very small work of most kinds can be handled with ease and convenience, or only with awkwardness and difficulty, according to the way it is approached.

Where a gas Bunsen burner, preferably one with air blast, is at hand, solder is one of the sovereign elements of the business in many ways.

In Fig. 1, let *A* be a brass watch-plate, or piece of cold-rolled sheet steel or brass, round, square, or any shape, and about ⅛ inch thick, or less to heat quickly. Is it desired to drill or face off to uniform thickness very small nuts, pawls—*B, C, D*—etc., etc.? Then have the piece *A* tinned, not too dauby; heat up and sweat any number of pieces on the same for drilling, turning or grinding. *A* can be held by hand in a round chuck, or clamped to lathe face-plate.

If a flat, thin ring like *G* is wanted, a much better job can be obtained by soldering a thick piece to the plate and boring and turning it, than by trying to work it out of thin stock of the required thickness. A curved spring like *E* can be worked to shape on the inside, then the outer curve turned or ground to a nice taper.

If the outer curve is made, and the inner form needed, solder to sheet metal stock near the edge to reinforce the work, then file away both work and plate together and unsolder the former.

Clamps like *F* are very useful in many ways. In Fig. 1 *H* is soldered to *A* to back up *E*. Two pieces held with these clamps, as *H* and *A*, can be easily marked for long lines and profiles. Holding a straight-edge in this way avoids double lines. Filing to profile on thin model and templet work is easy in this way. Make a pair of these clamps with long handles, say 1½ inches.

Fig. 2 shows a pair of hardened plates for sawing straight cuts with a thin saw—or a thick one, for that matter. A very thin watchmaker's saw is about as intractable a tool as the workman has to argue with; but these guides keep it in the straight and narrow way. The screw slots are oblong to admit of setting the plates to saws of different thicknesses. Fig. 3 is a plate for general and quicker use, made by the use of the one shown in Fig. 2, and for three thicknesses of saws. Clamp the work to the plates or the reverse, according to size of the former.

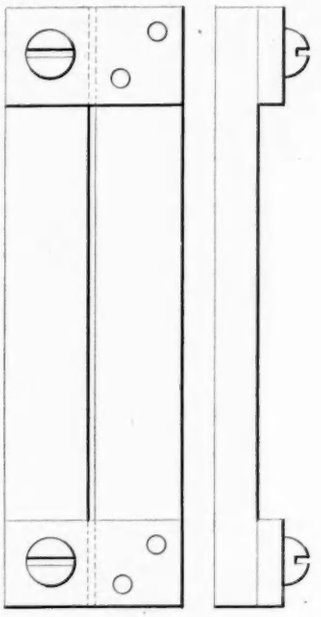


Fig. 2

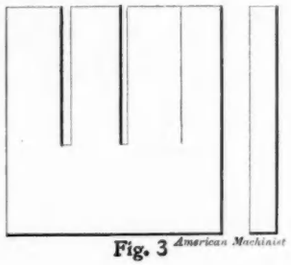


Fig. 3

SAWING JIGS.

Fig. 4 includes three views of a templet for filing a square hole in a round rod and was used for making the small boring bar shown in Fig. 5. Turn a collar *J* to fit the rod *K*. Reduce one end to a thin sleeve. File square templet holes in this, getting the lines for it in the milling machine or bench lathe with indexed head. Hold a scratch-awl in the tool-post, and mark the sides and ends of the square on the sleeve. Get spots in the same way on the opposite sides of the collar, for drilling *L* by. Use this hole *L* as a jig for the square hole, or to drill the hole for the same to be filed out. Locate and hold by the set-screw *M*.

Having filed the square hole for the cutter *N*, Fig. 5, sweat a plug into it and then drill and tap out the hole *O*, which encroaches on the plugged hole. This admits of the feed or adjusting screw *P* entering the notch in the cutter *N*, and regulating the cut. A set-screw *Q* makes the cutter more secure.

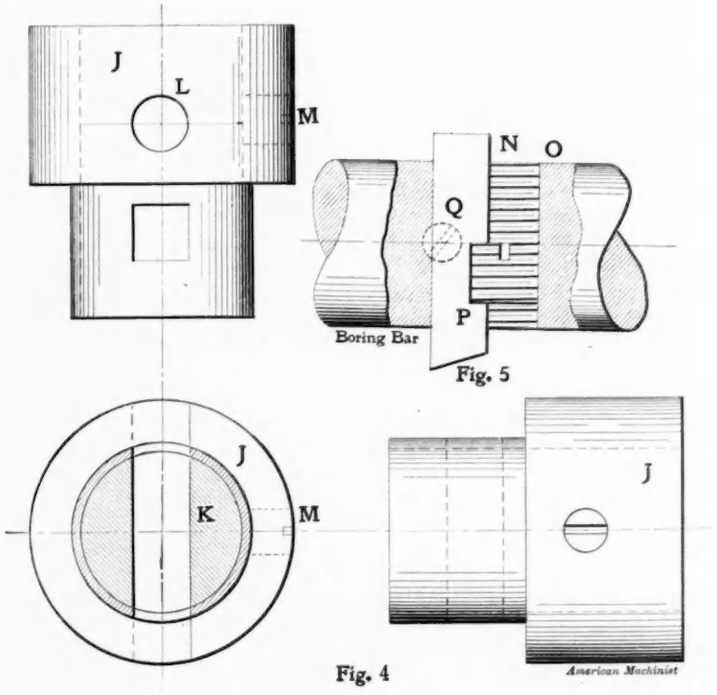


Fig. 4 Fig. 5

A BORING BAR AND FILING JIG.

Fig. 6 is a sectional view of a very heavy spiral spring for subpress die work, and so forth. Being a spring of maximum strength in minimum space, it is made by cutting a square thread screw on tool steel, and boring out the center; or making a hole first, sweating on to an arbor and cutting the thread afterwards. This

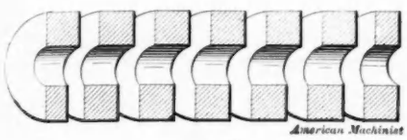


Fig. 6

A TURNED SPRING.

admits of making a very nicely finished spring.

Fig. 7 illustrates a common practice of cutting a V-thread with a compound rest, feeding in at 30-degree angle and cutting with the side of the tool R, which can be made highest to give top rake and a good cutting action.

Fig. 8 is a mascot. Most everyone now uses such standard screws as 8—32, 6—30, etc., etc. If you use many of any other kind, make a holder like Fig. 8. Do you

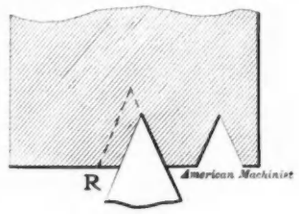


Fig. 7

THREAD CUTTING.

wish to slot a headless or any other kind of a screw without its whirling around? Screw it into the small end of the collet or holder by many or few threads, and lock it with the rear screw. This has a long point to follow up behind and check those exasperating little screws with only two or three threads to hold by while turning off ends or pointing in any way.

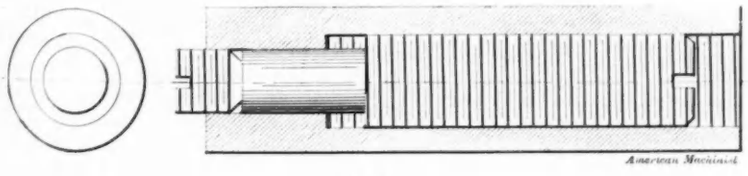


Fig. 8

A SCREW HOLDER.

Figs. 9 and 10 present an inside and outside staking punch, of which it is well to have a few in the sizes most used in experimental and model work—⅛, 3-16, ¼ inch, etc. They expand or close in collars for holding flanges, ratchet-wheels, etc., dispensing with the necessity for driving fits in many cases. The holes are made deep to reach down over or outside of a long dowel pin or stud and close in the metal around it for a hold-fast.

Fig. 11 is a hollow mill holder, a few of which save many a worry in the time of hurry. Using a holder is not only more convenient than holding the hollow mill in a dog, but admits of making the tools cheaply with a short piece of stock.

Drill and broach the hole out to size with taper, five-sided broach, and open the back with a larger drill. If made carefully and held on the lathe center, they cut to accurate size, smoothly and rapidly, and last a long time. It is only necessary to point the work, cut the large diameter first and follow with the next or threading size, if a shoulder screw.

If a number of shoulder screws are to be made, say, for 1-16 inch stock to swing on, use a collar like *S* for a stop for the mill. Then when it comes to assembling with a few of these screws; if the shoulder is too long, shorten it by turning it with a screwdriver in the mill held in a vise; if too short, use the vise shoulder mill in the same way and cut some from the under side of the screw head.

Philadelphia, Pa.

The Companie générale Transatlantique, which runs a line of steamships to New York, has made a qualified transfer of its shop at Penhoët, near Saint Nazaire, France, to a new company, in order to turn to better account the tool equipment, which hitherto had been little availed of except in the steamship company's own work

Echoes From the Oil Country—VIII.

SHRINK FITS.

"Mr. Osborne, can I bother you for a few minutes?" said Sam one day, coming into the office with his most engaging smile, which he used when he was in search of information.

"I guess you can, Sam," I said truthfully enough, for some of his questions did bother me more than a little; "what is it this time?"

"Why," said Sam, "you see, I don't just see through these shrink fits. Of course I understand some of them. You heated

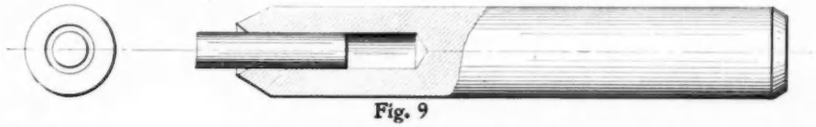


Fig. 9

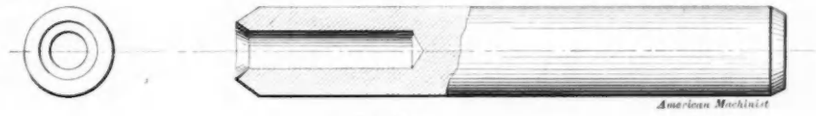


Fig. 10

STAKING TOOLS.

that band and put in onto the flywheel hub the other day, and I saw that worked all right and that the heat expanded the iron in the band so it was larger than when cold. One day, before you came here, Billy went over to Pioneer to shrink on a crank, and he took me along to help. It

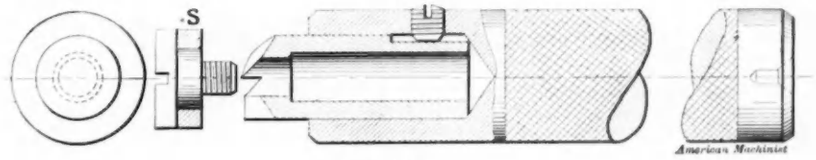


Fig. 11

HOLLOW MILL HOLDER.

was a big, heavy crank for a power, with a 5¼-inch hole, and it was about 16 inches across and 7 inches through the hole. Billy told me to heat it pretty hot, 'cause he had allowed 1-64-inch for shrink, and didn't want to have it stick, for if it did he would be stuck, too; so I blew her up pretty strong while Billy got things ready to put it on.

"We swung it up expecting to have an easy time, but the crank wouldn't start on; no, sir, not even start, and it was bright red, too, all through the hole from end to end. Billy rigged up a rope and hunted up a piece of an oak tree about 8 inches in diameter and 12 feet long, and tied it up where he could get a good ram at the crank. He said that crank was going on or he'd know why, that he could drive it on with that allowance cold—I don't believe he could though. Mr. Osborne, do you?—and now it would either go on or bust.

"It took us about 15 minutes fixing up the ram, and when we tried the crank to get it started straight and Billy just pushed the ram up to it, to get ready to hit, would

you think it, that crank just slipped on up to the shoulder and rattled, and it was loose still when the red was all out of it.

"Now, Mr. Osborne, why didn't that crank go on at first, and why did it go on at all, and why did it get bigger as it got colder?" Sam inquired as he finished his story.

"How did you heat it, on a blacksmith's forge?" I asked. "Yes," Sam said.

"Well, Sam, I think I can explain your trouble. You see, there's no doubt but that you heated it quickly, blowing most of the fire up through the hole, and you first expanded the crank into the hole, making it smaller instead of larger. On such a job the outside should be hottest, as then that will go out and pull the inner parts with it. Mind that in shrinking on pieces that are heavy compared with the size of the hole, heat from the outside and never from the hole. While you and Billy were rigging up the ram the heat was equalizing through the crank and consequently the hole was getting larger.

"You should never make a shrink fit with so much allowance that it won't go on without being red hot. If the hole is very long you may need to heat it red so as to have time enough to get the pieces together, but that is not very often the case. If you want it to hold tight, cool it off as soon as you get them together or you may stretch the outside one by the inside one expanding and then cooling last, or else you may get caught as I did once.

"I got orders to shrink on a flange coupling that another man had turned up. I thought the allowance rather large, but I didn't know much about shrinks and was told that was the regular thing and to put it on. I was working nights, and got it stuck half way on. The heat was all right; it was simply a case of too small a hole. I let it lie until morning, and then I told my trouble to our blacksmith. He was a very well-posted man and he told me to bring it out at once and he would fix it for me. I got it out, he laid the flange in the fire and before the red began to show he slipped the shaft out. I found the shaft where the flange had been was decidedly smaller than before and that the hole in the coupling was now two sizes. My friend, the blacksmith, said that would save some re-turning, and he quietly heated up the coupling and slipped it on, remarking as he did so that it was now a better job than it would have been if I had gotten it on in the first place, as it would be tighter .

"I rather doubted that.

"He took me over to a row of piston heads that he had shrunk onto the rods the night before, and he told me to try them with a hammer. To my surprise, I found them loose, although I had often seen a helper driving the rods in with a sledge when the heads were red hot. His explanation was that the heads heated the rods, and then the cooling down squeezed the rod while it was still large and soft from the heat, and then the rod shrank away from the head as it cooled off last, and that they were not nearly as tight as if made a good driving fit and driven in cold, and my experience bears out his statement."

"How much should be allowed to get the greatest holding power?" Sam asked.

"That I don't know, but I have never had a shrink I put on let go, to my knowledge, and I never had but three stick, and I only made one of those fits, and then I made it against my own judgment, but according to orders.

"My rule for many years has been, supposing two good, true, smooth surfaces, allow 1-1000 inch for each inch of diameter. If the surfaces are not smooth, increase this according as your judgment dictates. A piece raised only to the temperature of boiling water will expand more than the 1-1000 per inch from 60 degrees, so you see you don't need to melt a piece to get it on.

"The idea of cooling off is to prevent the inside from expanding from the heat of the other piece, as any piece without a hole in it and with a thin section will cool off inside last. This is not a hard and fast rule, as a band shrunk on a very heavy piece would not have heat enough in it to raise the temperature of the heavy piece much.

"Never, Sam, try to shrink a flywheel or a pulley with heavy arms onto a shaft unless you can heat the rim as well as the hub. I once saw a man try that. He made the shaft so it would push into the hole (which was slightly tapering) about an inch, and when the hub was hot he could not start it. The owner would not believe the statement, and he was only convinced by calipering the hot hole and when it had cooled calipering the hole again; the difference was very plain.

"Always remember that heat expands and the greater the heat the greater the expansion, but remember at the same time that it will expand in the line of least resistance, and it takes some experience and judgment to tell which way that is. The next time you have trouble hunt along that line, and don't think that the laws of mechanics are wrong, or have suddenly let go." W. OSBORNE.

Tools for Interchangeable Work—IV

BY JOSEPH V. WOODWORTH.

JIGS FOR DIFFERENT PARTS OF CLOTH CUTTER.

Fig. 1 shows a casting of semi-steel which was used as a standard to support the motor and upper works of the cloth cutter, the bottom *B* resting within the base described in No. 1. After the castings had been machined all over, and carefully sized for hight and width, they were ready for drilling, which was done in the jig shown in Fig. 2. In Fig. 1 there are 14 holes, and they had to be placed very accurately, as a slight variation would cause trouble when running, as the motor ran at 2,600 a minute. *D* is the center hole for the small shaft that supported the cutter and bevel gear; *E E* were two holes for supporting the lower bearing bracket, and *F F F* screw holes for fastening a plate 3-32 inch thick and of the same shape, to the other side. The three holes in the bottom *B* were for fastening in the base spoken of and the five holes in the top *A* for holding the motor case.

The jig used was of the box type, *G* was a casting with lugs cast on the bottom and the two ends for feet. After it was milled and squared up all over it was strapped square on the table of the miller and a 11-32 inch cutter run straight through at *O O* for the ends *A* and *B* of the work to set into, the distance between the most distant sides of the slots being enough to allow of the work entering easily. After this the pins *I* were let in as gage and stop pins for the work, the work resting on and against them. Holes were then drilled through the bottom of the slots *OO* and through the top *P* to

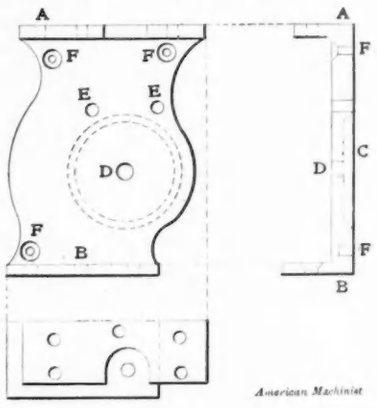
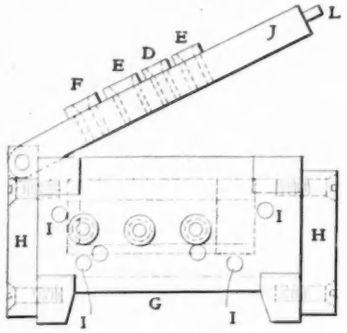


Fig. 1

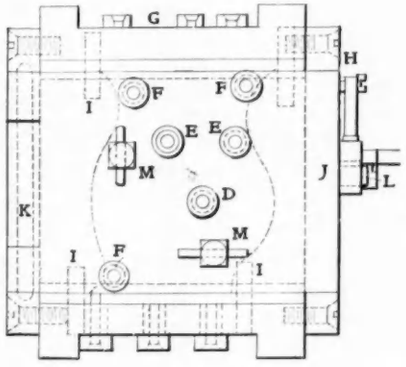
THE PIECE TO BE DRILLED.

allow the dirt to fall out. Two flat pieces *H H* of cast-iron were then got out and fastened to the body *G* with four flat-head screws and two dowels as shown. The hinged lid *J* was then made and cut out at one end to fit the piece *H* without play. A hole was drilled straight through *J* and *H* for the hinge pin *K* which was made tight in *J*, revolving in *H*. In the front view of jig *N* is the spring latch or lock fastened on the piece *H* with a strong flat spring. At the back of *L* is a Stubs steel pin driven into *J*. All the holes were laid out with a hight gage and drilled for the bushings, which were made, hardened and ground to size and let in. Two set screws were then made with small handles running through the heads as shown at *M M*. The pieces *H H* were made small enough to clear the lugs or feet at the bottom and sides, and the lid *J* just wide enough to take in the bushings *F F F*, *D* and *E E*, also the piece *H* on the right was cut away on the top until the lid *J* when resting on it would be square with the sides. After all this was done and all the parts assembled the jig was ready for work.

The lid *J* being thrown back, the work Fig. 1 was placed within it, resting on the pins *I I* for hight, and against the others for gaging it sideways. The lid *J* was then brought down sharply, when the spring latch *N* snapped over the pin L in such a way as to hold it tight and the two set screws *M M* were tightened on the work with just enough pressure to hold it. All the holes in the top were then drilled; the jig was turned up endwise and those holes drilled, then reversed and the other



END OF JIG.



TOP OF JIG.

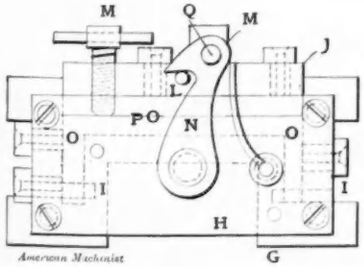


Fig. 2

FRONT OF JIG.

five drilled. The work was then removed by loosening the screws M M, pulling back the spring latch *N* by grasping the handle, *Q* and throwing back lid *J*. This jig proved very reliable, as its construction allowed of quick handling of the work, and also an easy escape for the drillings, there being openings on all sides. Of course a jig of this kind is only required where accuracy is desired and when the castings or work have been machined to a uniform size at the locating points.

In Fig. 3 is shown the lower bearing bracket which was fastened to the standard at *E E*, Fig. 1. This also was a semi-steel casting which was first chucked and turned out to shape shown at *C;* that is, with a fine thread halfway through and the hole enlarged to slightly more than the depth of the thread for the other half. The holes were finished all alike with a special tool. They were then, several at a time, put on a gang arbor and milled to size with a gang or forming mill. As will be seen, there are two wings for fastening to the standard, with the holes *A A* for the screws. As it was necessary that these holes should match those in the standard, and be exactly in the right position for hight, they were drilled in the jig shown in two views in Fig. 4, D was a piece of cast-iron, cut away and finished to the shape shown with a slot straight through the center to allow the work to rest on the two wings. A machine steel plate *F* was then made and fastened to the back, the work placed and fastened to *D* in the position shown and the hole C transferred to the plate *F* in which after being drilled and reamed, a stud *E* of tool steel tapped at one end to admit the lock nut *I* and just fitting the hole C in the work was driven in tightly. A plate *C* was then fastened to the top of *D*, as shown, with screws and dowels and the holes for the bushings *J J* laid out, drilled and reamed, and the bushings made and driven home. The lock-nut *I* was then made, which left the jig complete. The work was placed on the stud *E*, the wings resting on the sides of *D*, the nut *I* inserted and tightened, the holes drilled, and the work removed.

Fig. 5 shows the means of fastening the bevel gear *L* to the cutter *K*. The cutter was made elsewhere and had, of course,

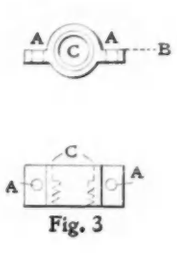


Fig. 3

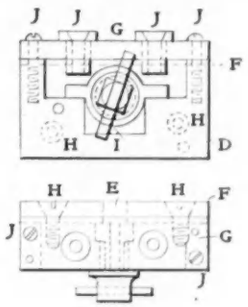


Fig. 4

LOWER BEARING BRACKET AND JIG FOR SAME.

the center hole and the other four, when received. In order to have the gear *L* true with the edge of the cutter a bushing *M* was turned up to fit the hole in the center of the cutter at *D* and projecting through far enough to enter the hole in the gear, with a flange running around the end and resting against the cutter as shown; the hole in the gear just fitted the bushing at *D* also. The four holes in the gear *L* and the bushing *M* were drilled by placing them together and inserting them into a jig, locating them (by the center hole) on a stud. The jig was made with a screw top which was run down on the work, thereby holding it fast, the holes were drilled for a 4-40 tap. The work was removed and the holes in the bushing tapped, while those in the gear were enlarged for clearance and countersunk. The parts were then assembled as shown in Fig 5.

The Paris Exposition—XI.

Returning again to the class of machine tools in which, as has been previously remarked, there is more in the way of novelty to be seen at Paris than in any other, an entirely new machine for planing the teeth of bevel gears is shown at Fig. 66; which we have had to reproduce from a wood-cut print in a circular given me by the makers of the machine—Smith & Coventry, of Manchester—no photograph being obtainable. This machine is of the class which generate the tooth curve (circular approximation to the involute), and it does it by the application of the odontograph principle; this principle being embodied in the machine in a very ingenious way and in such a manner as to make what must prove a very efficient tool, especially as the arrangement is such that both sides of a tooth are planed simultaneously, two tools being used. In this machine the blank to be cut is placed upon an arbor or spindle which also carries the index plate and which in turn is mounted in a saddle or head that is pivoted at a point on a line passing through the apex of the pitch-cone and the feed takes place by swinging this head upon the aforesaid pivot; this feature being the same as found upon several other bevel-gear cutters. From this point, however, it is quite a radical departure, and

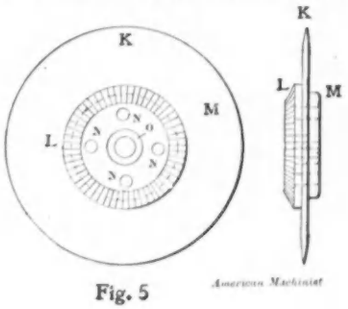


Fig. 5

the method of its operation will be best understood from the drawings, Figs. 67, 68 and 69. There are two cutting tools, tool-rests and tool-slides. At Figs. 67 and 68 the tools are designated by the letters *A A'* and the tool-blocks are moved upon the slides *B B'* by means of the connecting rods *C C'*, which are both attached to the crosshead *D*, that in turn is moved by the rod *E* from the crank plate *F*, which carries an adjustable crank-pin.

The two tool slides are not fixed in po-

sition, but both are pivoted at the same point (*G*), and the cutting edges of the tools are so placed as to move in lines that converge at this point, which is in a line intersecting the vertical line on which the blank-carrying and indexing spindle also pivots, as previously explained and as shown in the plan views, Figs. 67 and 68. At each stroke of the machine the blank is rotated one tooth so that, supposing a cut to have been just taken along the sides of one tooth, the next stroke will make a cut along the sides of the next adjacent tooth, and so on around the blank; after which the blank-carrying arbor is swung in by the feed mechanism the proper amount for the next cut around the blank; this feed motion being accomplished by means of an eccentric placed upon the blank-carrying spindle, which eccentric, by suitable mechanism, rotates a worm that engages with the teeth cut in the edge of the bed of the machine. With the mechanism thus far described, it will be plain that if the machine were set at work it would plane grooves in the blank that would be rectangular in cross-section, but tapering lengthwise in both width and depth; tending, in fact, to a point at the apex of the cone on the line passing through the centers of the pivots previously referred to. But the cross-section of the tooth to be produced is required to be defined by arcs of circles, the centers of which must be so located as to make the tooth of the required form, and the mechanism by which this is accomplished is shown diagrammatically by Fig. 69 and by the side-view drawing, Fig 67. The two tool slides have extensions or arms *H H'*, the extremities of which take the form of slotted arcs and are graduated. By means of studs and nuts arranged as shown, these arcs are attached to plates that carry studs *I I'*, and these studs pass through blocks that slide freely within the guides *J J'*, which guides are connected together by links, as shown, in such a manner that when these links are moved, the guides approach or recede from each other but always remain parallel; exactly the same as the two blades of a parallel ruler. The links that join the two guides are all pivoted at points upon a line *K L M*, which, as will be observed, is a continuation of the main center line before referred to, and the middle one of the three links extends from one guide to the other; having attached to it, at the point *N*, the connecting rod *O*, by which this link, and consequently, of course, the others as well, is rotated to make the guides *J J'* approach or recede from each other. And as the guides do this, it is of course evident that the curvature of the tooth outline produced will depend upon the rate at which they separate or rather upon the ratio existing between this rate of separation and the feed of the tools into the blank.

As the head carrying the blank-holding spindle is swung around on the bed of the machine for the feed, it moves with it the circular sliding bar *P*, which, near one end, is cut with gear teeth that engage with the sector *Q*, and this sector, through the medium of bevel gears, moves the slotted lever arm *R* to which the connecting rod *O* is attached; this arm being also graduated so that the movement given to the lever *R*, and consequently to the guides *J* and *J'*, may be varied with respect to the feed within certain limits. It is this later adjustment which provides for the difference in radius of curvature between the teeth of two mating gears of different sizes; such an adjustment being in fact not needed where all the gears cut are miters—*i. e.*, pairs of the same size. The radius of the tooth curve is always one-fourth of the radius of the pitch circle. All necessary graduations are provided for setting the machine, and the guides, moved in this manner, recede from each other as the tool goes deeper at just such a rate as makes the tools, which are thus also separated a little further each time the feed takes place, produce the proper form of tooth.

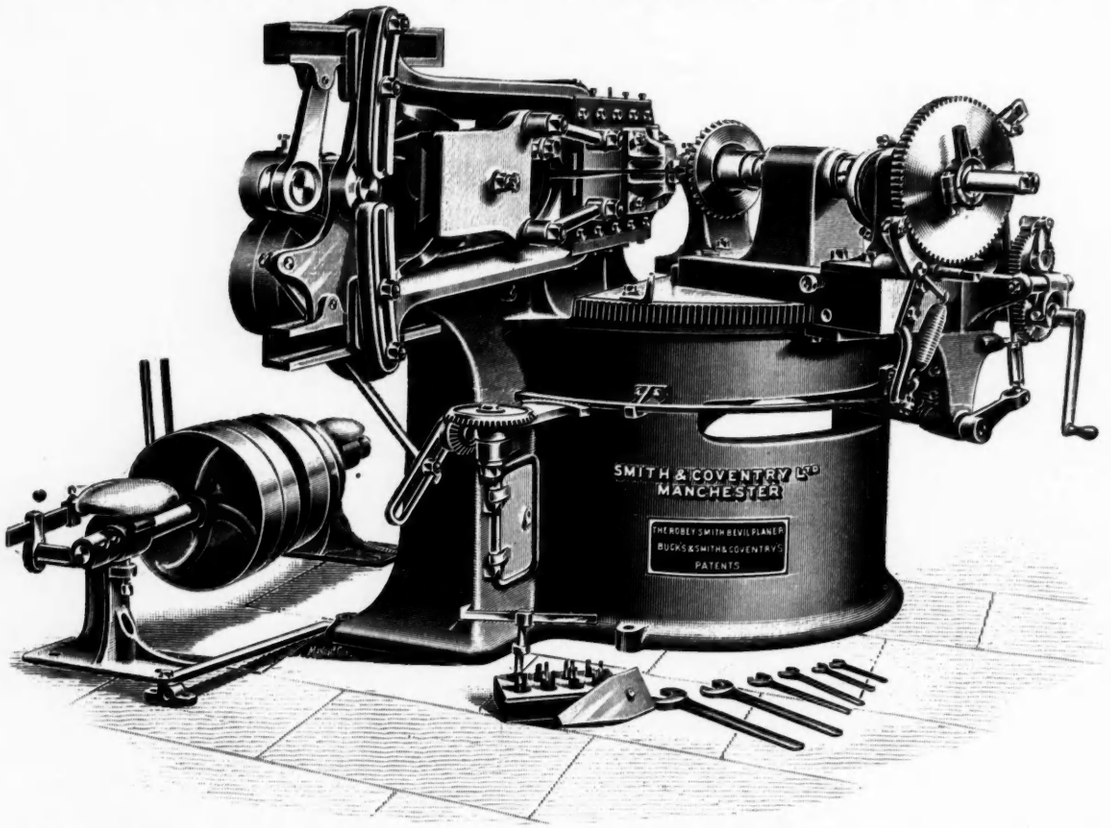


FIG. 66. A NEW BEVEL GEAR TOOTH PLANING MACHINE SHOWN AT PARIS BY SMITH & COVENTRY, OF MANCHESTER.

To set this machine up for planing a given gear seems like a good deal of a job, because there are so many graduated arcs, etc., that must be carefully set; but a table is provided for doing this, and when the machine once starts to work, it cuts rapidly, because two tools are working, and of course the machine is automatic, the feed being automatically released when the tools have planed to the required depth. Though it obviously takes more time to set it than is required for the Monneret machine described in our issue No. 29,

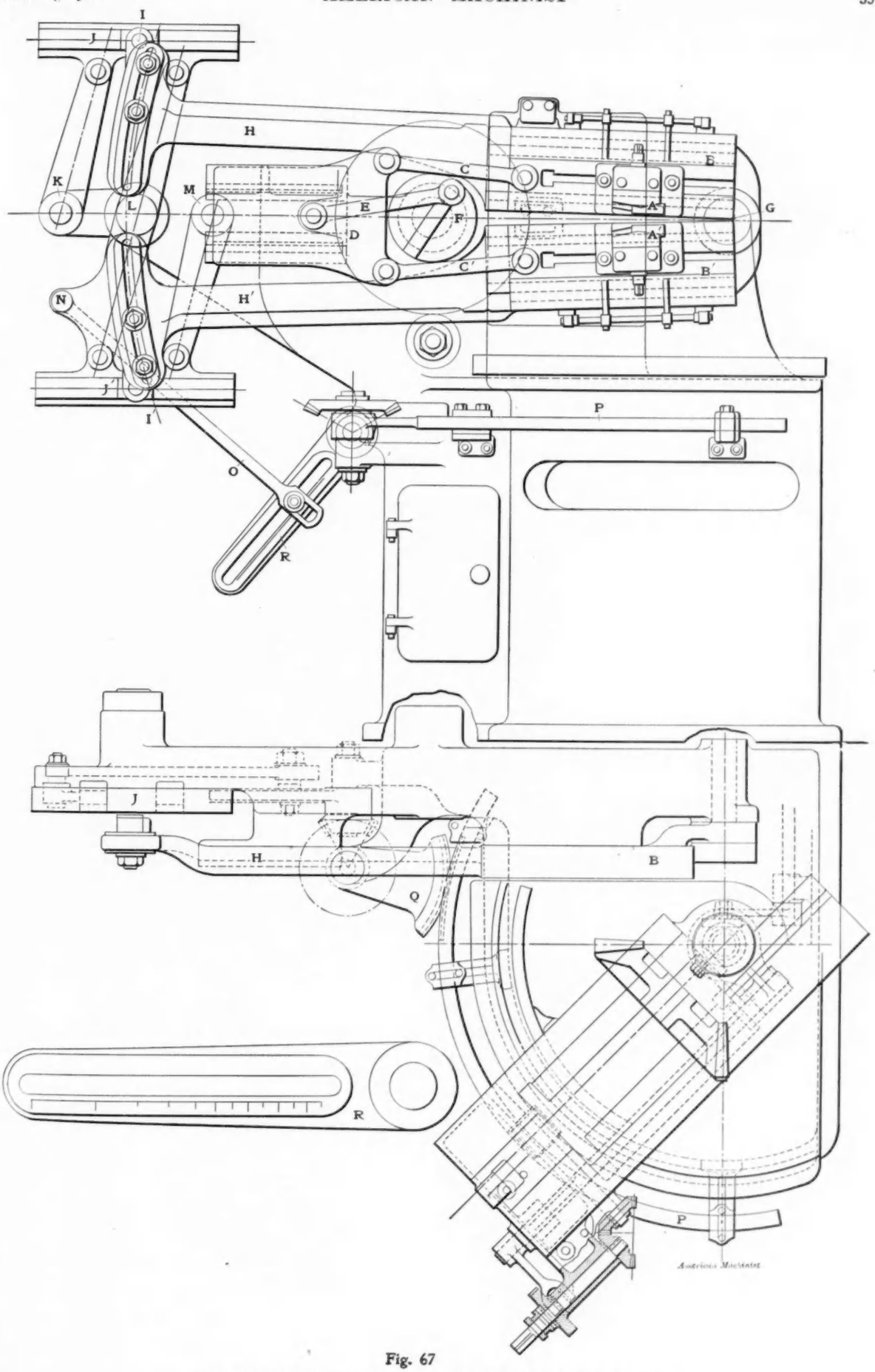


Fig. 67

SIDE VIEW AND PLAN OF ROBEY-SMITH BEVEL GEAR PLANING MACHINE.

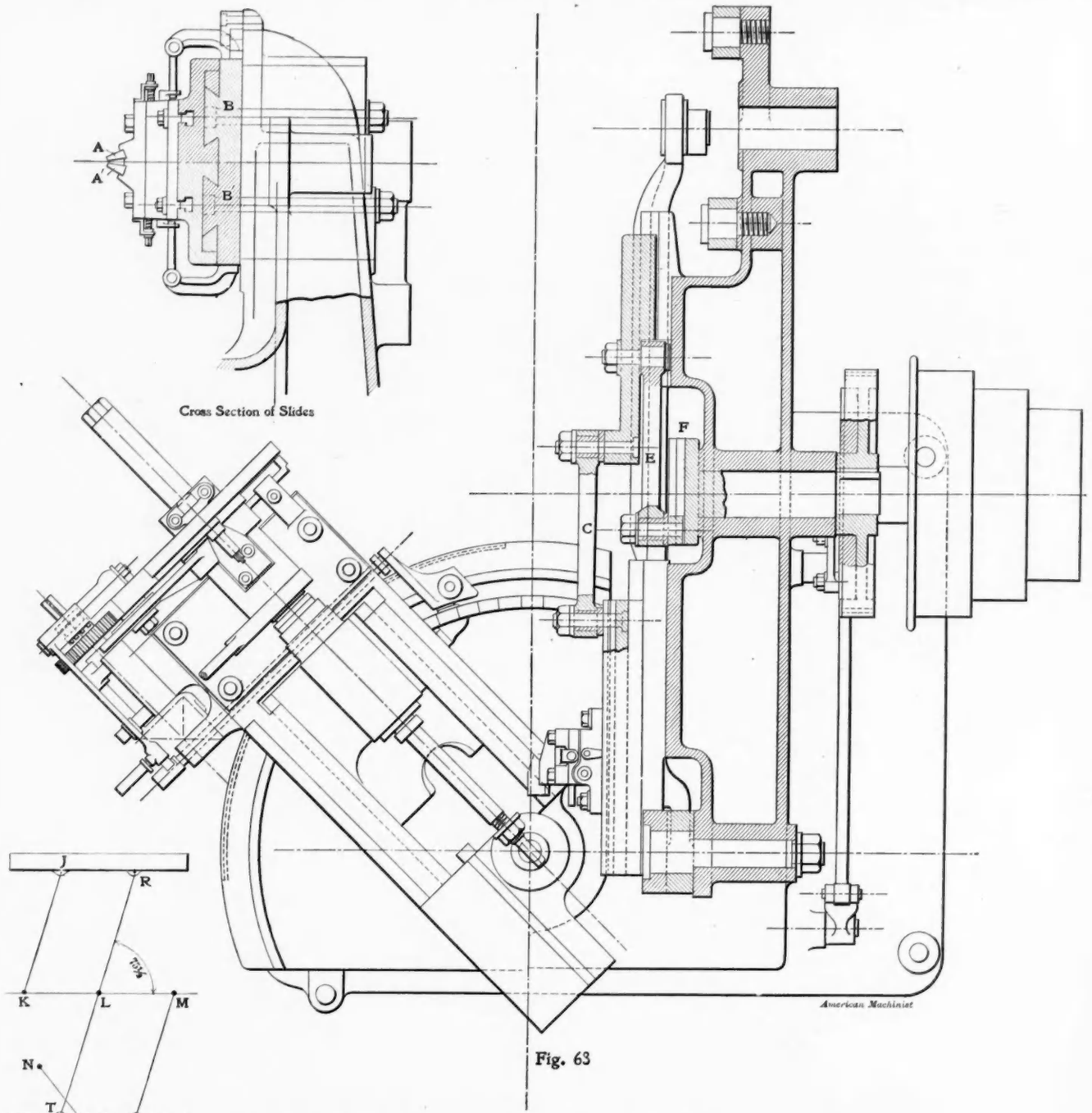


Fig. 63

PLAN AND PARTIAL SECTION OF ROBEY-SMITH BEVEL-GEAR PLANING MACHINE.

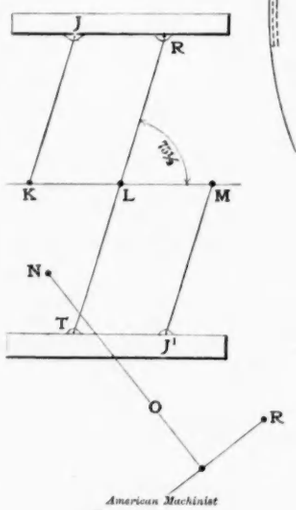


Fig. 69

ILLUSTRATING ODONTOGRAPH PRINCIPLE APPLIED TO BEVEL-GEAR PLANING MACHINE.

it of course cuts faster and has far less mechanism. Both are so new as to be almost revolutionary.

The Rice bevel gear machine is also shown at the American machinery building in the Vincennes Annex, and naturally attracts a great deal of attention; but there is no need of further reference to it at this time, as we fully illustrated and described it in our issue No. 19.

THE LATEST HENDEY-NORTON LATHE.

The Hendey-Norton lathe is especially well known in Europe, and is very frequently met with in the workshops there—the result of first having a good tool, then building it thoroughly well and pushing the business intelligently and persistently. The result is that a large proportion of the visitors to Vincennes already know of the lathe, but are interested in seeing the latest example of it, though it is doubtful if those who see it in the exhibition get as good an idea of its construction as is to be had from the engravings herewith presented, which show the latest form of the lathe with improved headstock and with an attachment for backing-off or relieving cutters, taps, etc. This lathe is designed especially for toolroom work and similar purposes, and so is provided with drawchucks; the backing-off attachment being also of course an outgrowth of the use to which the lathe has largely been put. Fig. 70 shows the lathe with this backing-off attachment in place, though the attachment itself is perhaps better shown in Fig. 71, where it is on the floor in front of the lathe. There is no need to go over the main features of the Hendey-Norton lathe—how any desired feed may be instantly obtained by the movement of a lever, and the change made so quickly in

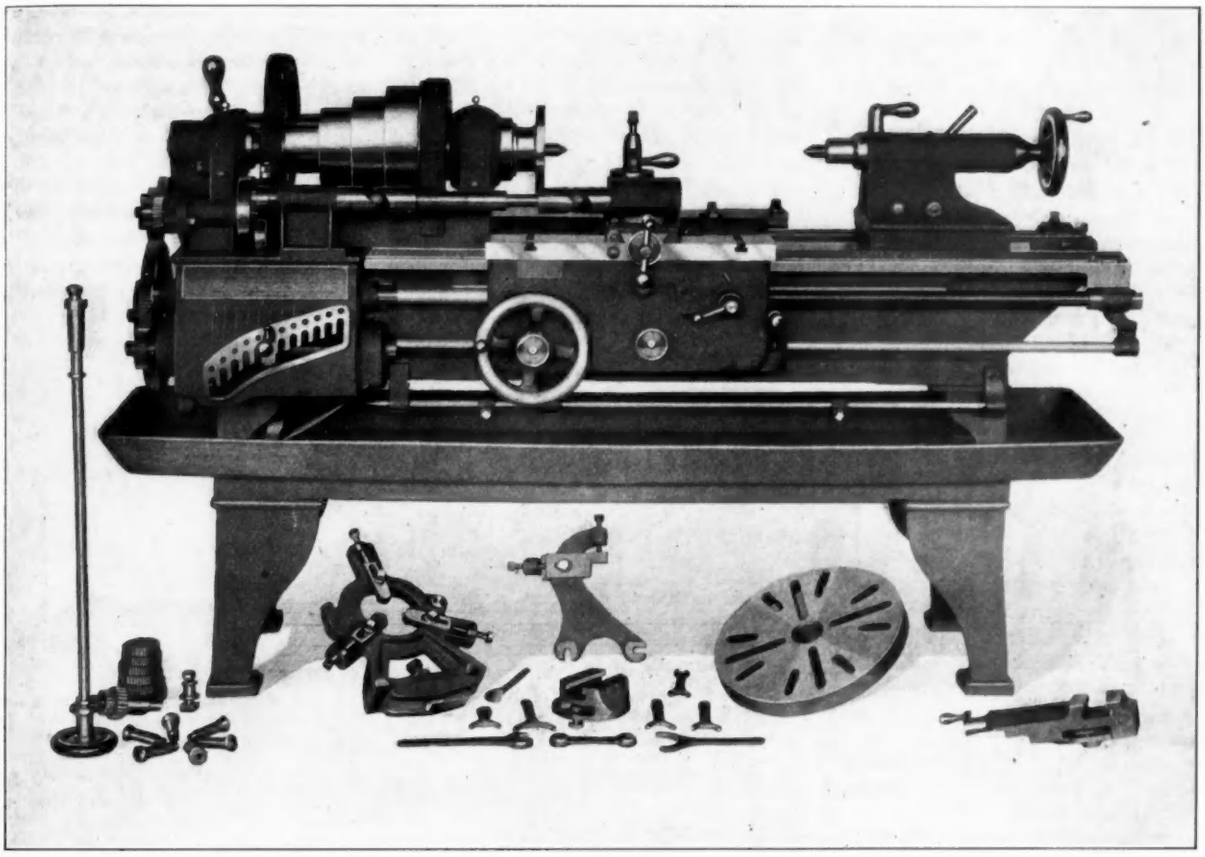


FIG. 70. HENDEY-NORTON TOOL-ROOM LATHE WITH BACKING-OFF ATTACHMENT, AS SHOWN AT PARIS.

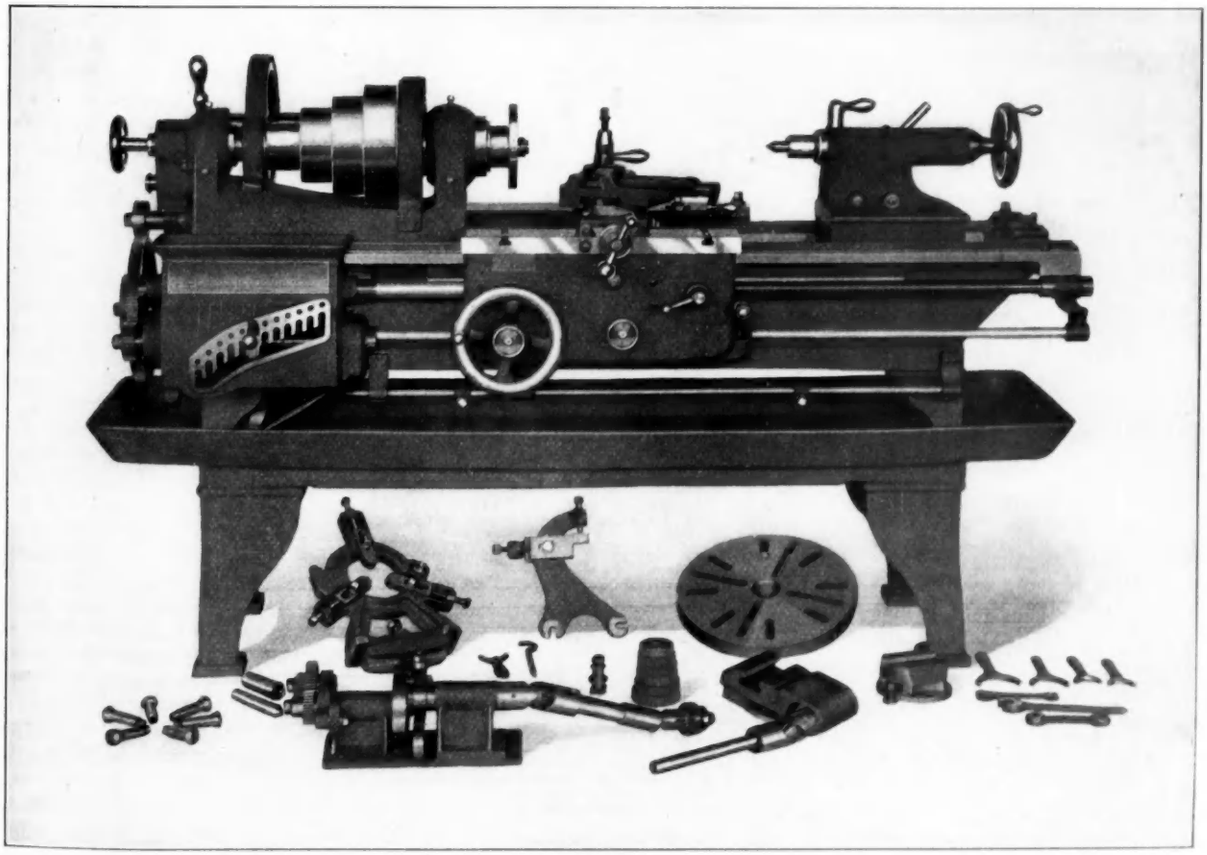


FIG. 71. HENDEY-NORTON TOOL-ROOM LATHE WITH DRAW CHUCKS AND BACKING-OFF ATTACHMENT, AS SHOWN AT PARIS.

most cases that the chip is not even broken; how the same movement of a lever serves in place of taking off and putting on other gears when screws are to be cut of various pitches; and how, either for turning or threading work externally or internally, a stop can be set, so that the tool will always stop in precisely the same place; so that shoulders may be duplicated and the necessity for cutting channels for threading tools to run into is avoided; or, rather, now the tool makes its own channel, and a very neat one, as the threading proceeds. All these things are, or ought to be, familiar to those who keep up with the times in matters of machine-shop equipment; but the section of the new headstock and the photograph of the parts composing it, shown in Figs. 72 and 73, will be especially interesting. It will be seen that both bearings are conical, but that the forward one brings up against a square shoulder. This forward journal is an integral part of the spindle, but the rear one slides upon it for adjustment, and is adjusted by turning the collar *I;* end motion of the spindle being taken up by the collar *L* and the cone pulley held in place with any desired end play by the collar *E*. It will be noticed also that both bearings are provided with ring oilers *O*, which run in oil reservoirs below, and that at each end of both bearings there is provision for returning the oil that flows out to the reservoirs, so that there is a constant circulation of oil when the lathe is running, special shapes being adopted for the spindle at the ends of the bearings, which shapes cause the oil to be thrown off into the regular channels and returned to the reservoir, instead of running over the lathe and on to the floor.

The relieving attachment for milling-cutters and taps consists of a special tool block and a frame, which fastens to the top of the bed over the gear box, this frame having in it bearings for two spindles. The spindle at the left is driven by gears that engage with one of the regular change gears. This spindle carries a cam with which a roller that is at the end of a lever engages and this lever oscillates the shaft, having the universal joints, that is connected to the rest. The connection between the lever referred to and the shaft which it drives is by means of interlocking teeth of triangular shape, which can be disconnected and connected in such a relation as to bring the forward and backward movement of the tool at just the right place to suit the teeth of the cutter as it is placed upon the arbor in the lathe. A few change gears afford facilities for backing off cutters having from 2 to 26 teeth, including every number up to 18, and a table is supplied for placing the right gears. This reminds me that Mr. Norton has shown me a blueprint change-gear table for this lathe, which is more formidable in appearance than anything else of the kind that I have ever seen. It may be remembered that the Pratt & Whitney Co. used to supply with their lathes a printed change-gear table mounted upon a board, which table gave not only the regular threads which it was intended to provide for, but also all the odd and fractional threads that resulted from any possible combination of the gears supplied. This, I believe, has been discontinued of late, perhaps because it was too much encouragement for the production of bastard threads; but Mr. Norton says that they find that a large number of their customers require special threads for certain purposes, not always known to him, and some of them are very far removed from the standard. It happens that the Hendey-Norton lathe with its gear train always in place, can by changing one gear above the gear-box be made to cut an entirely new series, and when all the possible pitches that can be cut by making a few changes of this kind are figured out it makes a pretty big table; the one before me having 2,196 little squares filled in with figures representing integral and fractional pitches that can be cut with 47 different change gears. Some of these are duplicates; I do not know just how many, but only a few, and I feel quite sure that after

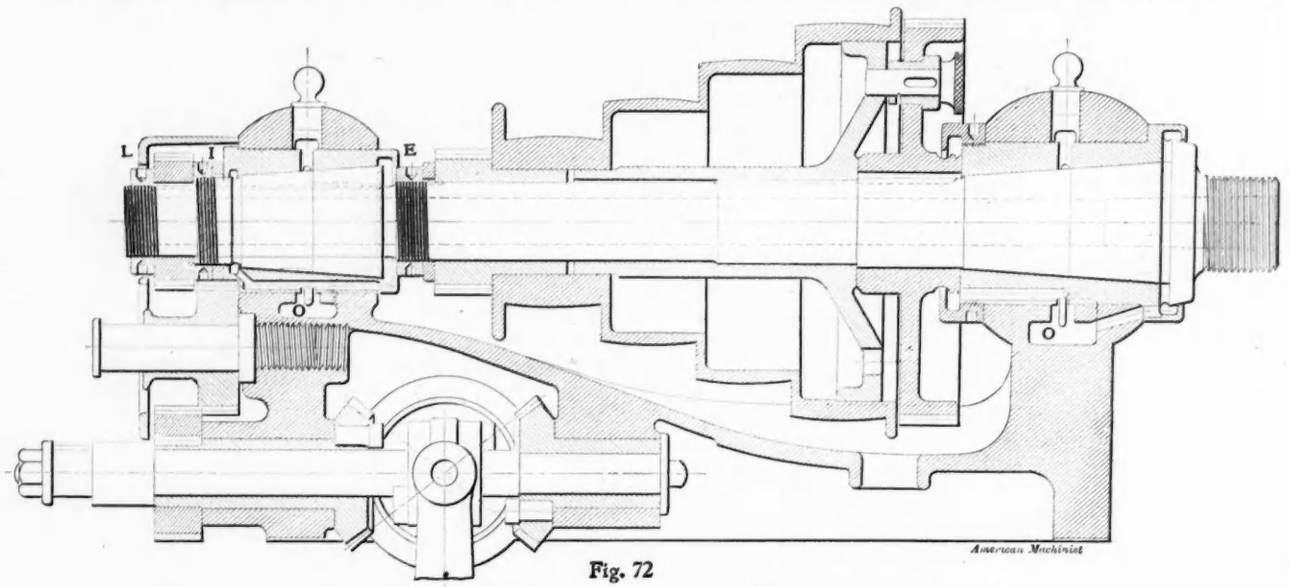


Fig. 72

SECTION THROUGH HEADSTOCK OF IMPROVED HENDEY-NORTON LATHE.

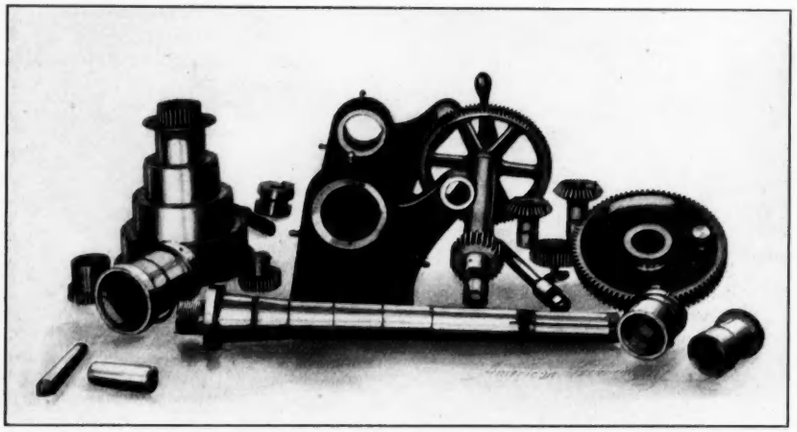


FIG. 73. PARTS COMPOSING THE HEADSTOCK OF THE HENDEY-NORTON LATHE.

the duplicates are taken out there will remain enough to satisfy the ambition of almost anyone that wants to produce odd threads. By referring to this table any special gear that may be wanted can be found and either made or ordered from the makers of the lathe; it not being designed or expected that any one user of the lathe will have use for all the gears.

A MOTOR-DRIVEN UNIVERSAL DRILLER.

The Niles-Bement-Pond Company makes a collective exhibit at Paris, and while it is very atractive, both at the Champ de Mars and at Vincennes all the establishments controlled by this company contributing to the display, the exhibit does not include tools that are new, to Americans at least, and most of them have been already presented in our columns; but at Fig. 74 is shown one of the tools exhibited which happens to be an unusually neat and happy solution of the motor drive problem. Reference to the photograph will show that the motor seems to exactly fit and to be much more appropriate to the position it occupies than motors usually are on machine tools, so far as appearance goes. The armature runs on a vertical shaft which is provided with suitable end-thrust bearings and drives, by a single reduction gearing, the vertical shaft at the side of the machine, which is otherwise unchanged from its former construction in which the vertical shaft referred to was driven by another vertical shaft that came down from the countershaft and was concentric with the column; which was thus allowed to swing to any desired position; as of course it can do with the motor as well. The motor is 2 horse-power at 250 volts and at the base is an automatic stopping box and reversing switch. The machine shown has a maximum distance of 6 feet from the center of the column to the spindle, it is completely universal and the weight of the column is borne upon balls that make it very easy to turn the column by hand. This particular tool was made by the Niles Tool Works, at Hamilton, Ohio, and the other tools exhibited include productions from the Bement and from the Pond shops, all going to make up quite a complete line of what are, for these establishments, mostly of the smaller sizes; it not being practicable, of course, for a builder of really heavy and large tools to exhibit them in an exhibition, especially when it is 3,000 miles away and within French territory. F. J. M.

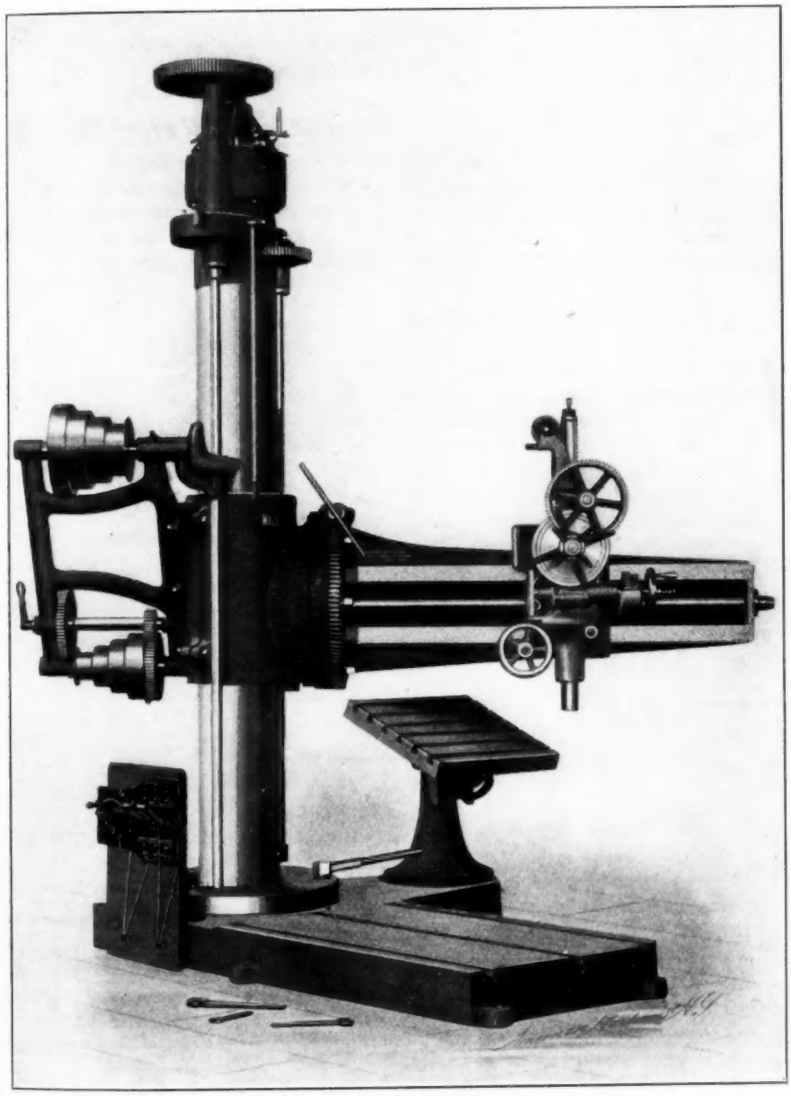


FIG. 74. UNIVERSAL RADIAL DRILLER WITH MOTOR ON TOP OF COLUMN.

Letters from Practical Men

The Use of Clay in Hardening Steel —An Extension Tool for the Shaper.

Editor American Machinist:

Your correspondent, "Toolmaker," in issue No. 36, mentions the advantage of the use of clay in hardening under certain conditions. I have used it also in other ways and have found its use advantageous.

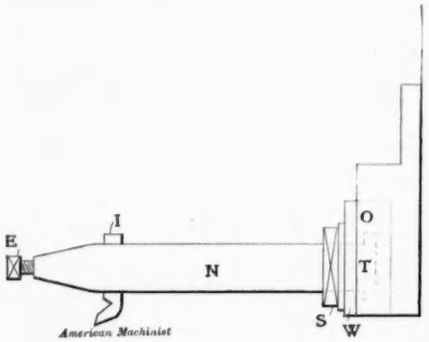
In hardening hammers, I have taken some clay, packed it in and around the hole and then wrapped a piece of sheet iron around the neck of the hammer head, leaving the peen and face bare. The hammer could then be heated and plunged bodily into water and the neck would remain soft, while the face and peen would be very hard. This avoids the risk of cracking through the hole and also has the advantage of leaving that part of the hammer very strong which does not need to be very hard. Of course, in tempering the hammer, it is heated in the center and the color allowed to start from there and go outward.

In hardening punching tools, etc., it generally happens that there are tapped holes for strippers or guides, which holes often cause trouble in hardening, since cracks are apt to start in them, due to the fact that when plunged into the water, steam is generated in the holes and cannot escape fast enough. To obviate this, I have filled such holes with clay when hardening, and it works like a charm.

Your correspondent also mentions a tool for slotting in the shaper. This calls to mind a job I had some years ago. The piece to be planed was a tool-steel forging, and owing to its peculiar shape it could not be forged very close to size. It had also projecting parts, such that an ordinary shaper tool, or even one with an extended cutting edge, could not be employed. The tool which was used is shown in the illustration. It resembled closely an ordinary cutter-bar such as is used in a boring mill or drilling machine. It was simply a long-nose *N*, which fitted into the flap of the tool-post at *T*, and into which tools of any desired shape or length could be inserted. *W* is a simple washer, and *S* is a nut with a fine thread. The tools were inserted as shown at *I* and fastened by means of set-screw *E*. Over 100 pounds of steel was planed off of this one block, and when finished, the piece did not

weigh much more than the metal removed.

The planing was done on a triple-geared crank shaper, and the machine was pushed for all it was worth. The result was that one portion of the way in the slotted lever wore away, finally causing the slides to thump at that point. A new lever was obtained and put in its place. The same thing occurred to this one. Finally I planed out the spot thus worn away, took a flat piece of tool steel, hardened it and dovetailed it in place. The shaper is doing good work to his day. I have recently found a shaper of the same make in another shop, which had been treated successfully in practically the same manner.



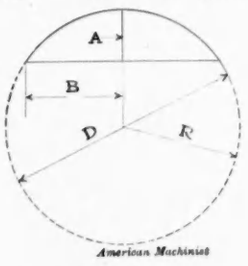
AN EXTENSION TOOL FOR THE SHAPER.

EDWARD J. KUNZE.

Finding the Radius.

Editor American Machinist:

In your issues Nos. 33 and 34 appears a formula for finding the radius of a circle, the length of the chord and hight of the arc being given. As fewer figures are required by the following formula, it may be preferred:



FINDING THE RADIUS.

$$D = \frac{B^2}{A} + A.$$

The notation is as given in the sketch. The formula is easily derived from the arc given in the above issues.

DRAFTSMAN.

A Bending Fixture.

Editor American Machinist:

The enclosed sketches show a jig which I designed for making the final bend in the piece as shown above Fig. 3.

The piece was blanked out in a die, as shown at *A*, and is mild steel 5-32 inch thick. It is stamped into the shape shown at *B*, which is a starter for the loops, as shown at *C*.

The device for making the final bend is shown in the three views, Figs. 1, 2 and 3, and consists of the cast-iron head *a*, which carries two hardened steel bushings *b b*, to the lower ends of which are keyed the two handles *c c*.

The upper ends of these bushings are cut away to a depth a little more than equal to the width of that portion of the pin where the bend is to be made, and a rounded corner is left, so that when the handle stands in the position shown at the right in Fig. 1, it is located at that point in the piece where the bend formed by the die leaves off; and as the handle is rotated to the position shown at the left, the ends are wrapped around the studs *d d*.

These studs are a working fit through the bushings, and to their lower ends is attached a cross-bar *e* by means of the two nuts, as shown. To this cross-bar is attached the lever *f*, and after the operation of closing the loops is completed, the studs are withdrawn from them by pressing down on lever *f*, which leaves the piece loose in the jig, so that it is easily removed; after which the lever and studs are restored to their normal position by means of the spring *g*.

This rig seemed to be entirely satisfactory, and as it may be of interest to some of the readers of the "American Machinist," I venture to send it.

A. C. MILLS.

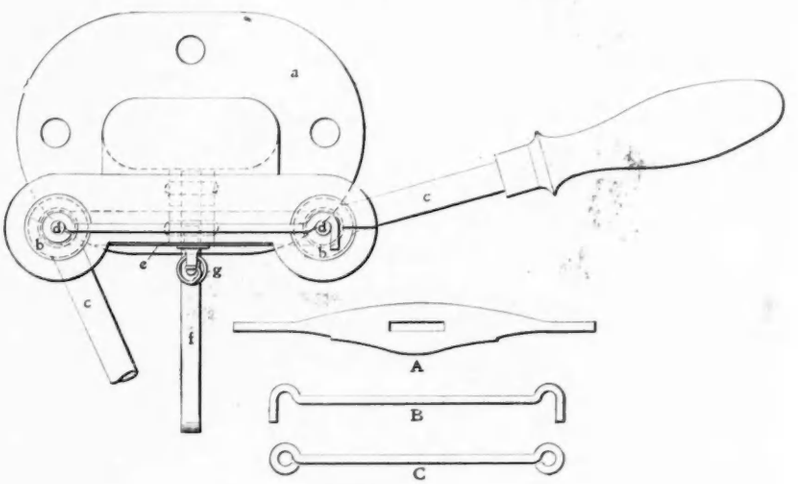


Fig. 1

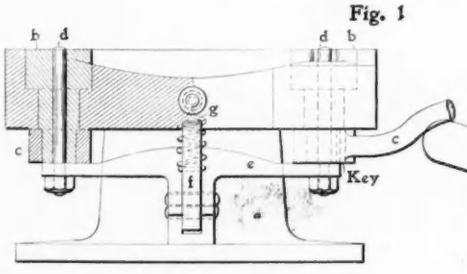


Fig. 2

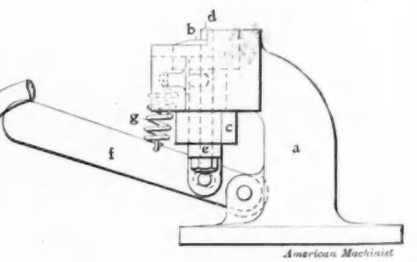


Fig. 3

A BENDING FIXTURE.

Chips as a Flux in Welding.

Editor American Machinist:

Possibly some of your blacksmith readers may know how to use chips from a bolt cutter as a flux in welding iron to steel. It was new to me in an experience of forty years as a machinist.

A blacksmith who owns a jobbing shop here asked, the other day, for some chips from the bolt cutter. On being asked what he wanted them for, he said to "weld iron and steel where a low heat is necessary," such as picks, etc. He dries out the oil from the chips and mixes them with borax. He is one of the cleanest smiths I ever worked after. R. K.

Columbia, S. C.

Three Different Ways of Molding It.

Editor American Machinist:

The enclosed sketches show how three different shops, working under practically equal conditions, differed as to the best method of doing the same job.

It was a rectangular base, a section of the sides and ends being like sketch Fig. 1. This section was crossed by ribs, forming pockets on the inside of the base. It was in the molding of these pockets that the three shops differed.

Shop No. 1 made their pattern so that the inside of the base would be formed by the green sand cope.

Shop No. 2 used no cope. A core print covered the cope side of the pattern, Fig. 2, the cores for forming the pockets drop-

ping into the impression made by the print and making all the cope necessary.

Shop No. 3 made their pattern the same as shop No. 1, but used cores for making the pockets. These cores were made to

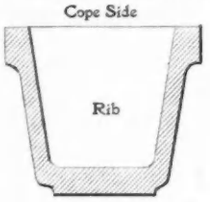


Fig. 1

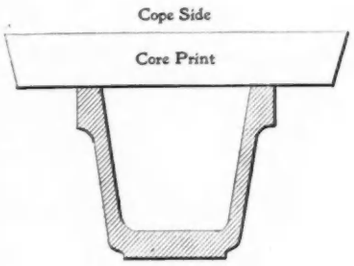


Fig. 2

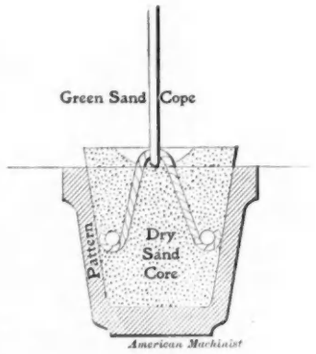


Fig. 3

THREE DIFFERENT WAYS OF MOLDING THE PIECE.

set in the pockets in the pattern, and projecting above it about an inch Fig. 3. Hooks were used to secure these cores to the cope, which was of green sand, the cores and cope all being lifted away together.

HOBO.

The Strength of I-Beam Girders With Reinforcing Plates.

BY C. F. BLAKE.

The following method of calculating the size of girders made up of I-beams and plates gives satisfactory results with very little arithmetic, and always upon the safe side. Referring to Fig. 1:

A = area of I-beam in square inches;

a = area of *one* flange of I-beam in square inches = ½ (A — area of web of I-beam);

a_1 = required area of *one* flange of *complete girder* = (a + area of cover plate);

b = width of flange of I-beam;

d = depth of I-beam;

t = thickness of web of I-beam;

S = *total* strain on flange of *girder*, in pounds, due to load;

f = allowable fiber strain per square inch;

M = bending moment in *inch-pounds*;

R = section factor = $\frac{M}{f}$.

y = diameter of rivet holes;

x = thickness of plate on compression flange;

x_1 = thickness of plate on tension flange;

c = effective width of plate on tension flange = $b - 2y$.

Then

$$\frac{M}{d} = S \quad (1) \qquad \frac{S}{f} = a_1 \quad (2)$$

$$\frac{A - d\,t}{2} = a \quad (3) \qquad \left.\begin{aligned} \frac{a_1 - a}{b} &= x \\ \frac{a_1 - a}{c} &= x_1 \end{aligned}\right\} \quad (4)$$

Suppose a bending moment of 580,000 inch-pounds is to be taken by a 10-inch, 25-pound I-beam, reinforced by two cover plates as in Fig. 1; f to be 16,000 pounds per square inch. Then from the hand-book of one of the structural-steel companies we find the area, A, of a 10-inch, 25-pound beam is 7.35 square inches; width of flange, b, is 4.66 inches; thickness of web, t, is .31 inch; and rivet holes 13-16 inch diameter. Following the formulas in order:

$$\frac{580{,}000}{10} = 58{,}000 = S. \quad (1)$$

$$\frac{58{,}000}{16{,}000} = 3.62 = a_1. \quad (2)$$

$$\frac{7.35 - (.31 \times 10)}{2} = 2.125 = a. \quad (3)$$

$$\left.\begin{aligned} \frac{3.62 - 2.125}{4.66} &= .32 \text{ say } \tfrac{3}{8}'' = x. \\ \frac{3.62 - 2.125}{4.66 - (2 \times 1\frac{3}{16})} &= .5 = \tfrac{1}{2}'' = x_1. \end{aligned}\right\} \quad (4)$$

Thus a 10-inch, 25-pound beam requires a ⅜x4⅝-inch cover plate on the compression flange, and a ½x4⅝-inch cover plate on the tension flange, to answer the conditions. $R = \frac{58{,}000}{16{,}000} = 36.2$, section factor required for the above conditions. By calculating R for the above combination of beam and plates from their respective moments of inertia about the center of gravity of the beam, we find $R = 38.25$. Thus the above method gives results upon the safe side.

Fig. 2 shows a method of finding the section factor R of any beam. Consider the flange divided into a rectangle 1, 2, 5, 4 and a triangle 1, 2, 3. The center of gravity of the triangle is at a point y, $.66b$ from the apex 3. Draw a line through y, completing the rectangle 4, 5, 6, 7, of which point x, at the intersection of the diagonals 7—5 and 6—4, is the center of gravity. Then:

$a = \frac{c - .66b}{2}$, and $d_1 = d - 2a = d - \left(\frac{2\,(c - .66b)}{2}\right)$ or $d_1 = d - c + .66b$;

A = area of beam in square inches;

A_1 = area of web in square inches = $t\,d_1$;

A_2 = area of *one* flange = $\frac{A - A_1}{2}$;

Then $R = \left(A_2 + \frac{A_1}{6}\right) d_1$.

Taking the above 10-inch, 25-pound beam as an example, A = 7.35 square

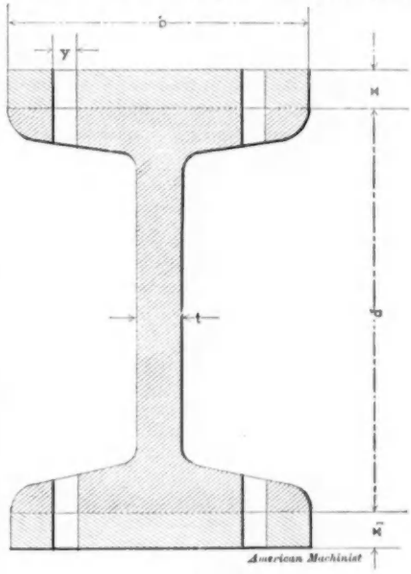


Fig. 1

THE NOTATION.

inches, c = .673, and b = .363, taken from hand-book of steel company, or from actual measurement of beam.

Then

$d_1 = 10 - .673 + (.66 \times .363) = 9.088''$.

$A_2 = \frac{7.35 - (9.088 \times .31)}{2} = 2.226$ sq. in.

Then $R = (2.266 + .469)\ 9.088 = 24.8$.

Young Engineers in Britain.

The way the situation looks to one young man in England is eloquently set forth in a letter he has written and which we find in "Engineering" for September 14. The letter is as follows:

"Sir—Will you be so good as to allow me, through the columns of your valuable newspaper, to ventilate a very substantial grievance? I refer to the difficulty that the would-be engineer meets with in obtaining employment, after he has spent years in endeavoring to qualify himself, should he be so unfortunate (?) as to possess no relatives amongst the ranks of our foremost manufacturing, consulting or contracting engineers.

"I will illustrate my point by my own case, as here I can speak with both knowledge and feeling.

"It was an unlucky day for me when, seven years ago, fired by the gilded fame of the 'metal chiefs,' I decided to embrace a profession that I fondly hoped would lead to wealth, if not to St. Paul's.

"The son of an officer in Her Majesty's

Army, I had no special inducement to take this step, but *quos Deus vult perdere, prius dementat.*

"Still, I took the fatal step, and the bells that rang out the expiring year 1892 of our Lord, rang me as a premium apprentice into the engineering workshops of Messrs. X, Y & Z.

"Paying a premium, by the way, was my second woeful error; but that is another story. Yet, how I sigh for my lost dollars now! 'Give me back my lost legions!' cried a classic warrior, and with equal futility I demand to be returned that phantom gold that once was mine.

"*Revenir a nos moutons,* I spent a period of three years amidst the grime and smoke of the large Midland town wherein these works were situated, and there amidst the throbbing of engines and the roar of furnaces misgivings first began dimly to assail me. But disillusion was a long time coming. Visions of boundless wealth had indeed receded with increase of years, but still I comforted myself with the hope of earning an honorable living and a comfortable competence. Now I know that all is vanity and vexation of spirit in the en-

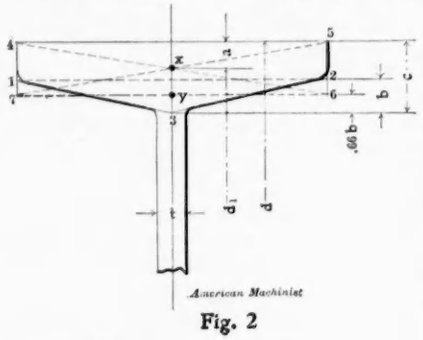


Fig. 2

FINDING THE SECTION FACTOR.

gineering world, except, indeed, for a favored and *hereditary* few.

"On leaving these workshops, about whose methods and managers I should like to write freely, I committed the folly of all follies: I became a student of an engineering college, not 100 miles from the Imperial Institute, and here I spent some years in pursuing the scientific chimeras of its well-paid staff.

"Here I learned to differentiate, to integrate, to indicate, to vegetate, and many things besides. I learned how to carry coal scientifically in boiler trials, and how to make nicely-finished drawings of antiquated and impossible machines that then to my sublime ignorance appeared almost divine in conception. With many others I learned these things.

"In this calm abode of science, in this peaceful temple of technical education, came few warnings from the world outside of the real problems that confront the engineer. From the professional chair all earthly matters glided away, and listening to the wisdom that issued from the professorial lips, the wondering students thought nor cared to think of naught else. Happy and innocent was the careless life I led as an engineering student in the premier engineering college of this mighty city! And its professors! By the waters of the Thames I sit down and weep, when I think of thee, oh ....! Yes, I weep, but tears of divine despair, being able now to say with Ecclesiastes that increase of wisdom is increase of sorrow.

"Many, many moons have waxed and waned since I left that college in the chosen haunt of education, South Kensington, and what have I found since my departure? In what have my long years of physical and mental toil benefited me? Vainly have I sought employment. From morn to noon, from noon to dewy eve, I have flitted about Westminster in search of work. Countless have been the posts I have applied for, and innumerable are the distinguished engineers I have interviewed. Pounds have I spent in useless advertisements.

"Yet have I made a few discoveries. I now know that my years spent in the engineering shops of Messrs. X, Y & Z were entirely wasted, for they were too few in which to become even a bad mechanic, and too many in which to fool about with a file. I have learned that the flimsy varnish of theoretical knowledge one acquires at an engineering college has no commercial value; and I now know that in the engineering profession, to have the education and the instincts of a gentleman is to be severely handicapped. And, above all, I have the bitter consciousness that if in any other calling I had applied the same energy, done the same work, and spent half the money in its acquirement, I should by now be in a fair way towards making a success.

"But prematurely aged, and with care sitting on my faded cheek, I must soon relinquish the struggle to find even a crust. The Bird of Time has but a little way to flutter, and the Bird is on the wing. But before I die of inanition, exhaustion and weariness, I would say to those who would become engineers, 'Go and hang yourselves before taking such a step, unless, indeed, you have one or more near relations in the profession who will help you. If not, read what I have written, and reflect.'

"Thanking you, dear sir, beforehand for your courtesy in publishing my woeful tale, I am, your obedient servant,

"LUCIFER."

Table of Integral Right-Angled Triangles.

The erection of a perpendicular by the construction of a triangle whose sides are respectively 3, 4 and 5 units in length is a familiar and handy device. The following table gives a greater range of choice in the shape or proportions of the triangle employed, and may be a welcome addition to many a "pocket-book." The table is a list of all integral, or whole-number, right-angled triangles the units of whose least sides do not exceed 20. It is taken from an article on solutions and properties of the right-angled triangle in a recent issue of "The Locomotive."

A LIST OF ALL INTEGRAL RIGHT-ANGLED TRIANGLES WHOSE LEAST SIDES DO NOT EXCEED 20:

Hight	Base.	Hypotenuse.
3	4	5
5	12	13
6	8	10
7	24	25
8	15	17
9	12	15
9	40	41
10	24	26
11	60	61
12	16	20
12	35	37
13	84	85
14	48	50
15	20	25
15	36	39
15	112	113
16	30	34
16	63	65
17	144	145
18	24	30
18	80	82
19	180	181
20	21	29
20	48	52
20	99	101

An Engineering Wonder.

A correspondent kindly sends us a clipping from a local newspaper, which professes to describe a new power-developing device at the Hervey Machine Works, Kansas City. The following is perhaps as much as our readers will want:

"The main part of the engine consists of an outer cylinder, or 'shell,' within which a power piston with air chambers revolves. The air is supplied through the top of the cylinder from a tank which is charged to a pressure of 50 pounds by means of an ordinary bicycle pump. The piston, which has four air chambers, starts to revolve and operates a cut-off or eccentric. This equalizes the flow of air to the piston and regulates the power of the engine. The piston also operates a small pump attached to the outer cylinder, and this pump replaces the loss of air through leakage and expansion. By means of a worm and screw gear this pump enables the machine, with a force represented by one-fourth of one horse-power, to develop 300 pounds of air pressure. To prevent this new force from overtaxing the strength of the machine a governor is used to hold the supply of air in check. The air chambers have spiral springs which transmit the air power to the piston. The engine now being finished weighs 200 pounds and will develop 1½ horse-power. Its greatest advantage is found in the fact that it costs practically nothing to operate

it. The air that starts it is used three times by means of expansion."

It should be next in order to organize a stock company with a capital of, say, $10,000,000, advertise by the page and sell stock. Some of the liquid-air promoters ought to get hold of it.

Registration of Patents in Cuba.

Attention is being called in Havana to the fact that all persons being in possession of legal patents of invention taken out in Madrid, Spain, and registered for the Island of Cuba must file, within a term of six months from the date named duplicates of the specifications, drawings and models belonging to their patents or a certified copy of the same, together with a certificate showing that their patents are in force in Spain, so that such patents may be protected against foreigners.

Further, that American patents that have been presented for registration in Cuba, and those which shall be so in future, shall be registered at once, provisionally, in the special register kept by the Secretary of Agriculture, Commerce and Industry, on condition of deciding in due course of time what may be deemed fit about their final registration or absolute rejection. A. F. TENNILLE.

Evening School of Electricity.

The Evening School of Electricity under the direction of the Harlem Branch of the Young Men's Christian Association, at No. 5 West 125th street, will open for its third season in the first week in October. It will be in charge of Mr. S. A. Small, assistant instructor in electricity at Columbia College, a thoroughly practical man who has seen active service in every branch of electrical work.

The sessions will be held on Tuesday and Friday evenings, and the course will consist of forty-eight lectures. Mr. Small will commence by thoroughly grounding the class in the fundamental rules and principles of electrical engineering, and during the course will cover fully the various branches of telegraphy, telephony, police and fire alarm telegraphy, arc lighting, alternating current apparatus, power distribution, street railways, the electric automobile, the "X" rays and wireless telegraphy. The lectures will be illustrated by a powerful stereopticon and a large amount of apparatus will be used in illustrating the work.

Personal.

Max Daunert, manager of the New York branch of Schuchardt & Schütte, Berlin, has returned from a trip to Europe.

R. Hakewessell, of the Acme Machine Screw Company, has left on a four to six months' business trip. He expects to spend most of this time in England.

Peter J. Connor, chief designer of the Gisholt Machine Company, Madison, Wis., sailed for Europe on the steamer Deutschland, September 25, for an extended trip in the interest of his firm.

Henry F. Frevert, hitherto manager of the sales department of the Garvin Machine Company, New York, with which concern he has been associated most of the time since 1892, has accepted a business connection with the Niles Tool Works Company, New York.

Obituary.

Frederick N. Stanley, president of the Stanley Rule & Lead Co., died at New Britain, Conn., September 28, fifty-five years old.

William H. Johnson, master mechanic of the Eastern State Penitentiary of Pennsylvania, died September 21, fifty-four years old. He was head janitor of Machinery Hall at the Philadelphia Centennial Exhibition in 1876.

Watts Cooke, president of the Passaic (N. J.) Rolling Mill Company, died September 25, sixty-seven years old. He was born at Matteawan, N. Y., but most of his boyhood was spent in Paterson, N. J. He spent five years in the locomotive works of Rogers, Ketcham & Grosvenor, later was foreman at the Danforth-Cooke Locomotive Works, and after that master mechanic of the Lackawanna Railroad, losing his right arm in an accident on the road. He was one of the founders, in 1868, of the Passaic Rolling Mills, later becoming the president of the company.

Thomas Marshall, a prominent foundryman of Pittsburgh, Pa., died in that city September 24, seventy years old. Mr. Marshall was a native of Pittsburgh, and started to learn the iron molder's trade when 15 years old. In early manhood he became associated with Harrison & Wyman, who had contracts from the Russian Government for steel and ordnance, and he spent 8 years in Russia. He was later in the foundry business under the firm names of Dickson & Marshall and Morris & Marshall, and in 1885 the Marshall Foundry & Structural Iron Works was founded, he being the directing manager. This concern is said to be one of the largest of its kind in the world.

New Catalogs.

We have received from the Skinner Chuck Company, New Britain, Conn., its 1900 catalog. Herein are shown and described lathe chucks, drill chucks, planer chucks, face-plate jaws, etc. Special chucks for all purposes are made to order. The catalog is priced, furnished with a telegraph code and is gotten up in plain, neat form. Size, 6x9 inches.

Bardons & Oliver, Cleveland, O., send us a 253-page pocket catalog of their turret machinery of every description and complete outfits of tools for the same. This is a catalog of the direct, practical sort, with tabulated dimensions for the extensive line of machines to which it relates and a system of code words running through it. The illus-

(*Continued on page* 44.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 22.

Dies & punches. Amer.Hdw. Co., Ottawa, Ill.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

United States and Canada patent for sale, $100 (quick). Address Box 336, AM. MACH.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Manufacturer wanted for medium weight machinery. Address "Established Line," Box 292, AMERICAN MACHINIST.

Manufacturer, to take interest and build a gas engine ; two types ; running engines can be examined. Box 902, Pittsburgh, Pa.

Machine shop for sale in the eastern part of Wisconsin, doing a general repair and jobbing business, also selling engines, boilers, machinery, etc. Box 306, AMER. MACHINIST.

For Sale—Twenty back volumes of the "American Machinist ;" $25 will take the lot ; also seventeen back volumes of the "Scientific American ;" $15 will take them. Address A. H. Stell, Box 416, Brookville, Pa.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded ; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Wanted—Position by mechanical engineer, to assist in designing, drafting and erecting power plants. Box 323, AMER. MACHINIST.

Marine and stationary engine designer and draftsman, age 34, with extensive experience, wants position. Address Box 326, A. MACH.

Mechanical draftsman, graduate, 12 years' experience, wants position ; steam engines, general machinery, blast furnaces. Box 347, AMERICAN MACHINIST.

Position wanted by a competent draftsman ; effective and accurate in work ; experience on general and interchangeable machinery ; good references. Box 345, AMERICAN MACHINIST.

Technical graduate, 3 years' experience, shop, drafting room and office, desires position in office or as salesman for manufacturing concern, or insurance inspector. Box 344, AM. M.

Toolmaker and draftsman of 20 years' experience on special machinery and gas engines is open for engagement ; assistant to superintendent preferred. Box 346, AMER. MACH.

Young mechanical engineer, Stevens graduate, extensive machine-shop and drawing-room experience on steam engines and power-house work, desires position. Box 339, AM. M.

Am looking for a situation as foundry foreman on engine, sawmill or general jobbing ; 20 years' experience as foreman ; am a sober and steady man. Address "Pig Iron," AM. M.

Master mechanic desires a change ; would prefer a position with steamship company or manufacturing concern ; 7 years with present employers on machinery installation and general repair work. Box 320, AMER. MACH.

A mechanical and electrical engineer, experienced, practical, thoroughly posted on modern methods and resourceful, desires position as superintendent, chief draftsman or consulting engineer. Address Box 343, AM. M.

Mechanical engineer with 9 years' business experience would like a position in office or to represent an engineering concern or sales

(*Continued from page* 43.)

trations are half-tone and are numerous. In the book are reference tables. Size, 4x6 inches.

The General Electric Company is distributing a ninety-two-page pamphlet on the subject of "Aging of Transformer Iron," containing five important articles that have been issued regarding this subject, as follows: "The Aging of Transformer Iron," by Prof. W. Elwell, Goldsborough; "On Slow Changes in the Magnetic Permeability of Iron," by W. M. Mordey; "Effects of Prolonged Heating on the Magnetic Properties of Iron," by S. R. Roget, B. A.; "Hysteresis in Sheet Iron and Steel," by Arthur Hillyer Ford, and "The Aging of Transformer Steel," by J. A. Capp. The pamphlet will be furnished free of charge upon application to the General Electric Company.

"A Few Astronomical Instruments" is the title of a book issued by Warner & Swasey, of Cleveland, Ohio, and devoted to the illustration of the various notable astronomical instruments that have been built by them from time to time and ranging from 6-inch equatorials up to the great Lick and the Yerkes 40-inch tubes. Fine views of various observatories are also given; but there is no description, the publishers evidently, and rightly, thinking that this array of pictures, with simple inscriptions telling what observatories the instruments were made for, is sufficient to make the desired impression, and they are no doubt ready to give all required particulars to those who may be specially interested. The book is 9½x12 inches, bound in cloth and splendidly printed.

Manufacturers.

J. Manley Inzer, of Ashville, Ala., will erect a flour mill.

The North Paterson (N. J.) Gas Company will erect a new plant.

The Monmouth Ice Company will build a 30-ton-a-day ice plant at Long Branch, N. J.

Albert Pike, machinist, on Pleasant street, Worcester, Mass., is building a blacksmith shop.

Cone Brothers, Troutdale, Ore., will move their sawmill to Portland or erect a larger one there.

J. J. Larabee, Worth Center, Jefferson County, N. Y., is making preparations to rebuild a mill.

F. M. McDaniel, Carthage, Mo., intends to erect a woolen mill on Main and Meridian streets, that town.

The cotton gin plant of B. F. Hudgins, near Smithville, Texas, has been burned, and will be rebuilt next season.

An addition is to be made to the plant of the Fandango Mills, of Millburn, N. J., manufacturers of binders' board.

Niss Brothers & Co., spoke manufacturers, have broken ground for the erection of a new plant on Broad street, York, Pa.

Jeremiah Wallworth & Sons, Philadelphia, Pa., manufacturers of shoddy, find it necessary to enlarge their plant at Upland, Pa.

The Deane Plaster Company, manufacturer of porous plasters, Yonkers, N. Y., has been granted a permit for a new factory building.

G. A. Bergland, Milwaukee, Wis., has purchased timber land in Michigan, to work up the product of which a sawmill will be erected.

Welch & Landregan, makers of women's shoes, on Willow street, Lynn, Mass., have decided to nearly double the capacity of their factory.

The Charles Parker Company, Meriden, Conn., manufacturer of hardware and piano

(*Continued on page* 45.)

VALUABLE BOOKS JUST PUBLISHED.

Gas Engine Construction

A Practical Treatise Describing in Every Detail the Actual Building of a Gas Engine.

By HENRY V. A. PARSELL, Jr., and ARTHUR J. WEED, M.E.

Large 8vo. Very fully illustrated. 300 pages. Cloth.

Price, $2.50.

This book treats the subject from a practical standpoint. The principles of operation of Gas Engines are clearly and simply described, and then the actual construction of a half-horse power engine is taken up, step by step, showing in detail with half-tone illustrations of the actual work—the making of a Gas Engine.

Horseless Vehicles, Automobiles, and Motor Cycles.

Operated by Steam, Hydro-Carbon, Electric and Pneumatic Motors.

By GARDNER D. HISCOX, M. E.

Large 8vo. 459 pages. 316 illustrations. Cloth.

Price, $3.00.

A Practical Treatise for Automobilists, Manufacturers, Capitalists, Investors, Promoters, and everyone interested in the development, care and use of the Automobile.

This book is up-to-date and very fully illustrated with various types of Horseless Carriages, Automobiles, and Motor Cycles, with many details of the same.

It also contains a complete list of the Automobile and Motor Manufacturers with their addresses, as well as a list of patents issued since 1850 on the Automobile industry.

Gas, Gasoline and Oil Engines.

By GARDNER D. HISCOX.

Third Edition, revised and much enlarged. 365 pages. Large octavo. Illustrated with 270 handsome Engravings. **Price, $2.50.**

Full of general information about the new and popular Motive Power, its economy and ease of management. Also chapters on **Horseless Vehicles, Electric Lighting, Marine Propulsion, etc.**

Mechanical Movements,

Powers, Devices and Appliances.

By GARDNER D. HISCOX

Large 8vo. 402 pages. 1649 illustrations, with descriptive text. **Price, $3.00.**

A Dictionary of Mechanical Movements, Powers, Devices and Appliances, embracing an illustrated description of the greatest variety of mechanical movements and devices in any language. A new work on illustrated mechanics, mechanical movements, devices, appliances, etc., etc.

Combustion of Coal and the Prevention of Smoke.

A Practical Treatise for all Interested in Fuel Economy and the Suppression of Smoke.

By WILLIAM M. BARR, M. E.

Author of "Boilers and Furnaces," Etc., Etc.

One volume. Nearly 250 pages. 85 Engravings.

Price. $1.50.

This book has been prepared with special reference to the generation of heat by the combustion of the common fuels found in the United States, and deals particularly with the conditions necessary to the economic and smokeless combustion of bituminous coals in **stationary and locomotive steam boilers.**

☞A special and detailed illustrated circular of any of these books mailed on request.

IN PREPARATION

An extensive and complete work on Compressed Air, entitled

Compressed Air in All Its Applications.

Large octavo. 700 pages. 500 illustrations.

This book will be a complete treatise on the subject, as far as it is possible to make it so, comprising the physical and operative properties of Compressed Air from a vacuum to its liquid form. Its thermodynamics, compression, transmission, expansion and its uses for power purposes in mining and engineering work; pneumatic motors, shop tools, air blasts for cleaning and paintings, air lifts, pumping of water, acids and oils; aeration and purification of water supply, will all be treated as well as railway propulsion, pneumatic tube transmission, refrigeration and numerous appliances in which compressed air is a most convenient and economical vehicle for work—with air tables of compression, expansion and physical properties.

This work will be the most comprehensive on the subject of Compressed Air, giving both the theory and application.

☞On application, we will send a large illustrated circular, and table of contents of this book, as soon as the same is ready.

☞We publish a line of books for Machinists, Mechanics, Inventors, Engineers, Draftsmen, Students, and all practical trades, and will send our catalogs to any one, in any part of the world, free on request.

☞Any of the above books sent free to any part of the world on receipt of price.

NORMAN W. HENLEY & CO.,

15 Beekman St., NEW YORK.

Situations Wanted—Cont'd.

agency handling power-plant equipments, etc.; would fit into almost any mechanical line; at present assistant to manager of large manufacturing company. Address Box 338, AM. M.

Practical superintendent with technical education, capable of organizing or reorganizing a machine plant according to the very latest methods, aggressive, and plenty of executive ability in carrying out plans, at present in charge of 350 men on engines, pumps and all kinds of power-plant machinery, will be open for engagement December 1. Parties requiring a general superintendent, please address Box 337, AMER. MACHINIST.

General superintendent and machine works manager; 30 years' practical experience; expert draftsman; highest references from past and present employers; experienced in printing presses, webs, stop cylinders, two-revolution, jobbers and lithograph; hydraulic machinery, steam and power plants, machine tools also in specialties; correspondence solicited with parties requiring a first-class man either as superintendent, manager or manager of sales department. Address Box 286, AMERICAN MACHINIST.

Help Wanted.

Wanted—An experienced foreman to take charge of drop forge plant. Address Box 335, AMERICAN MACHINIST, giving experience.

Draftsmen desiring extra money, state where employed, confidential. Edwin Guthrie, Corcoran Building, Washington, D. C.

Wanted—Machinist to take charge of shop in Rochester, N. Y., employing 25 hands and growing fast; must be up to date; give experience, reference, age, etc. A. L. G., AM. M.

Wanted—Toolmaker, machinist and planer hand on small automatic machinery at large factory, short distance from city; give age, wages expected and where having been employed. Address Box 342, AMER. MACHINIST.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, moiders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Foreman for brass department of manufacturing establishment, to take charge of 15 to 20 men; must be familiar with modern brass practice and the operation of tools; state age, experience, wages, etc. Box 340, AMERICAN MACHINIST.

Wanted—A1 salesman to sell "Simplex" time recorders on commission, exclusively or as a side line in United States, New England excepted; state territory wanted and give references and experience. Simplex Time Recorder Co., Gardner, Mass.

Wanted—Mechanical foreman to handle from 50 to 100 men; must be thoroughly experienced machinist and good organizer; man with electrical knowledge preferred; replies must state salary desired, full reference and age. Address "Rapid Worker," care AM. M.

Six or eight boys wanted to learn trade in modern machine shop; applicants must be strong and active, at least 18 years old, and have good school education; only those of mechanical turn of mind need apply; write for terms. The Hendey Machine Co., Torrington, Conn.

Wanted—Machinist; first-class planer and vise hand; only those experienced in woodworking machinery need apply; best of references required; good wages and steady employment to right party. John T. Towsley Mfg. Co., Evans, north of Gest st., Cincinnati, Ohio.

Wanted—25 good vise hands on light machine work; only good, steady men need apply; to such, good pay and permanent positions are offered; state age, wages now received, where you have been employed, whether single or married. American Machine & Foundry Co., Hanover, Pa.

The New System OF EDUCATION Steam Engineering

Mechanical, Electrical, Civil and Mining Engineering; Architecture; Drawing; Surveying; Chemistry; Shorthand; Book-keeping and English Branches

TAUGHT BY MAIL.

Students qualified to pass examinations.

We have helped thousands to better positions and salaries. Send for free circulars, stating the subject in which you are interested.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS,

Box 819, Scranton, Pa.